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by Estela Bee Dagum

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The X-II-ARIMA seasonal adjustment method

by Estela Bee Dagum

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Preface

The need for a seasonal adjustment method that would produce more accurate current estimates of seasonally adjusted data has been long recognized by Statistics Canada and other central statistical agencies.

As far back as 1973, Dr. Estela Bee Dagum, then head of the Seasonal Adjustment Methods Unit, initiated research to remedy a serious weakness of the officially accepted U.S. Census Program, Method II-X-11 Variant, developed by Julius Shiskin, Allan H. Young and John C. Musgrave in 1967. The recalculation of seasonal factors when current data were added to a series often produced large changes in the seasonal factors, even for observations several years back from the current period. This did not seem reasonable. The possibility of such changes meant that the seasonal factors used could be considered final only after many years of data had been added to the series.

By 1974, Dr. Dagum had successfully achieved a major theoretical breakthrough which enabled her to subsequently develop what she called the X-11-ARIMA method of seasonal adjustment. This method basically consists of extending the unadjusted series with one or two years of extrapolated values from ARIMA (Auto-regressive Integrated Moving Average) models of the Box and Jenkins type fitted to the series, and then seasonally adjusting the extended series with the X-11 program. The combination of the ARIMA modelling and extrapolation with the moving averages of the X-11 reduces significantly the size of the revisions to the forecast and current seasonal factors. For the majority of the economic time series, the seasonally adjusted data can now be considered final after two years rather than three years of revision. These two main properties of the X-11-ARIMA have been proved theoretically and are corroborated empirically by a large number of series.

The X-11-ARIMA method was officially adopted by Statistics Canada in January 1975 for the seasonal adjustment of the main Labour Force series and other economic indicators. The procedure was then applied by separately running two different computer programs: first, the ARIMA program which generated the projected values from a model already identified by the user; and second, the X-11 which produced the seasonally adjusted series from the original unadjusted series extended by one or two years of extrapolated values.

As more experimentation was carried out with ARIMA modelling, it was found that a small number of models fitted and extrapolated satisfactorily the values of a large number of series. This fact and the increasing demand for the method in Canada and other countries, led to the development of the new automated version of the X-11-ARIMA which combines two programs into one. This version of Statistics Canada X-11-ARIMA automatically selects the ARIMA model used in the extrapolation phase from a set of three models, according to given guidelines of acceptance. There is also an option for those users who would prefer to submit their own model. The program includes new graphs and tables and a set of statistics to assess the quality of the seasonally adjusted data.

This publication is divided into three main chapters. Chapter I discusses the foundations of the method and gives a detailed description of the new options. Chapter II deals with the composition of various seasonally adjusted series and introduces some tests to analyze the smoothness of the composite. The composition can be made by summation, subtraction, multiplication and division. Chapter III is the user's manual of the computer program to seasonally adjust time series and to perform the composition of several seasonally adjusted series.

The following persons of the Seasonal Adjustment and Time Series Staff provided valuable technical and computer assistance to Dr. Dagum for the preparation of this automated version of X-11-ARIMA: Guy Huot, John Lothian, Marietta Morry, John Higginson, Pierre-A. Cholette,

Stephen Tamasi, Alfred Papineau and Kim Chiu. Special acknowledgement is made to Bernard Altschuler, U.S. Bureau of Labor Statistics, for his important computer support at the final stage, particularly for the composition of various seasonally adjusted series.

PETER G. KIRKHAM,
Chief Statistician of Canada.

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Chapter I

FOUNDATIONS OF THE X-11-ARIMA SEASONAL ADJUSTMENT METHOD

Section 1. Introduction

The majority of the seasonal adjustment methods so far developed are based on univariate time series models. They are selected mainly for their simplicity and can be applied without specialized knowledge in a subject matter field.

A few attempts have been made to estimate seasonals based on causal explanations but none of them reached further than the experimental stage. Mendershausen (1939), for instance, tried to regress the seasonal for each month on a set of exogeneous variables (meteorological and social variates) in order to build an explanatory model for seasonality but his empirical results were inconclusive.

Univariate time series methods of seasonal adjustment try to estimate the generating mechanism of the observations under the simple assumption that the series is composed of a systematic part which is a well determined function of time, and a random part which obeys a probability law (Anderson, 1971; Dagum, 1974). The random element is assumed to be identically distributed with constant mean, constant variance and zero autocorrelation. The feasibility of this decomposition was proven in a famous theorem by Herman Wold in 1938.

The methods of estimation of the components of a time series can be grouped into two broad categories (Dagum, 1978.b and 1979.b):

regression methods; and

moving average techniques, also called linear smoothing procedures.

The regression methods assume that the seasonals and the other systematic components, trend and cycle, are deterministic functions over the entire span of the series.

The methods based on moving averages or linear smoothing filters assume that, although the time series components are smooth functions of time, they cannot be closely approximated by simple functions over the entire range of time under consideration. The assumptions implicit in the moving average procedures are that the trend, cycle and seasonals are stochastic and not deterministic.

The majority of the seasonal adjustment methods officially adopted by statistical agencies belong to the category of moving average techniques. They include: the U.S. Bureau of the Census Method II-X-11 variant; the BLS seasonal factor method; the Burman Method of the Bank of England; the Berlin Method, ASA II; the method of the Statistical Office of the European Economic Communities of Brussels; and the method of the Dutch Central Planning Bureau. These methods have often been criticized because they lack an explicit model concerning the decomposition of the original series and because their estimates for the observations of the most recent years do not have the same degree of reliability as compared to those of central observations (Kuiper, 1976 and Dagum, 1976.b).

The lack of an explicit model applies to the whole range of the series. Moving average procedures do make assumptions concerning the time series components, but the assumptions are valid only within the span of the set of weights of the moving average.

The second limitation is inherent in all linear smoothing procedures since the first and last observations cannot be smoothed with the same set of symmetric weights applied to central observations. Because of this, the estimates for current observations must be revised as more data is added to the original series. Frequent revisions, however, confuse the users of seasonally adjusted data, particularly if the revisions are relatively large or if they introduce changes in the direction of the general movement of the adjusted series. In fact, faced with the problem of controlling the level of the economic activity, policy makers will hardly base their decisions on seasonally adjusted data that are subject to significant revisions whenever new information is available.

The Statistics Canada X-11-ARIMA, as developed by Dagum (1975, and 1978.c) does not share the two common constraints of moving average procedures. It offers an ARIMA model for the series and minimizes the revision of the seasonals in mean square error.

The X-11-ARIMA basically consists of:

Modelling the original series by integrated autoregressive moving average processes (ARIMA models) of the Box and Jenkins (1970) types.

Extrapolating one year of unadjusted data at each end of the series from ARIMA models that fit and project well the original series. This operation, called "forecasting" and backcasting" is designed to extend the observed series at both ends.

Seasonally adjusting the extended (original) series with various moving averages of Method II-X-11 variant as developed by Shiskin, Young and Musgrave (1967). In addition, the user now has the option of applying a centred 24-term filter to replace the centred 12-term moving average for the preliminary estimation of the trend-cycle. This new filter gives better results for series strongly affected by short cycles (less than three years) or sudden changes in trend.

The ARIMA part incorporated into the X-11 program plays a very important role in the estimation of seasonal factor forecasts and concurrent seasonal factors when seasonality is moving rapidly in a stochastic manner, a phenomenon often found in key economic indicators (Dagum, 1978.a). Since the series are extended with extra data, the filters applied by the X-11 to seasonally adjust current observations and to generate the seasonal forecasts are closer to the filters used for central observations. Consequently, the degree of reliability of the extended series for current estimates is greater than that of the unextended, and the magnitude of the revisions is significantly reduced. Similar conclusions were obtained from comparisons made with other seasonal adjustment methods based on moving averages (Kuiper, 1976).

Generally, a reduction of about 30% in the bias and of 20% in the absolute values of the total error in the seasonal factor forecasts for the 12 months (four quarters) has been found for Canadian and American series (Kuiper, 1976; Farley and Zeller, 1976; and Dagum, 1978.b). The percentage reduction for those months (quarters) corresponding to peaks and troughs is larger than the average for the whole year.

Pierce (1978) shows that the ARIMA extrapolation makes the X-11-ARIMA a minimum mean square error seasonal adjustment method and that, in fact, this type of extrapolation would minimize the revisions of any moving average seasonal adjustment procedure in the mean square error sense. Similar conclusions are obtained by Geweke (1978) who extrapolates the future values of the series using the spectrum and one ARIMA model.

For series with rather stable seasonality, a significant improvement can be obtained when the trend-cycle is growing fast or the last year of data is one with a turning point. The final weights of X-11-ARIMA to estimate the trend-cycle are a combination of the symmetric Henderson weights and the asymmetric weights of the ARIMA model used for the extrapolated data. Since these final weights change with the ARIMA model fitted to the series, they reflect the most recent movement of the series and, as a result, seldom miss a turning point. Better estimates of the seasonal-irregular ratios (differences) are obtained which then are averaged to produce stable seasonals.

From the viewpoint of seasonal adjustment, another important advantage of X-11-ARIMA is that it offers a statistical model for the whole range of the series. The existence of a model that fits the data well fulfills the basic underlying principle of seasonal adjustment, namely, that the series is decomposable. If a series does not lend itself to the identification of an ARIMA model (here considering all AR, MA and ARMA as subclasses) which simply describes the general structure of the series in function of past values and lagged random disturbances, any further decomposition into trend, cycle, and seasonals becomes dubious. In fact, the lack of fit by an ARIMA model indicates that the series is practically a purely random process, or that it is so much contaminated by the irregulars that its systematic movement is unidentifiable.

The X-11-ARIMA generates extrapolated values of the raw data such that the one lead projected value has a minimum mean square error and thus can be used as a benchmark for preliminary figures. This is particularly useful to producers of raw data obtained from incomplete returns, as is often the case with series that are flows.

Section 2. ARIMA Models and Extrapolation

A fundamental step in the improvement of the seasonal adjustment by the X-11 program (equally applicable to any seasonal adjustment method based on moving averages) is to decide what kind of extrapolation method should be used to extend the original series. For the X-11-ARIMA, the selection was made according to the following requirements (Dagum, 1978.b):

The extrapolation method must belong to the "simplest" class in terms of its description of the real world. No explanatory variables must be involved, the series should be described simply by its past values and lagged random disturbances. This requirement is necessary to facilitate the incorporation of the extrapolation method into the X-11 program, since the procedure has to be automated.

The identified models must be robust to the incorporation of one or two extra years of data, and the corresponding extrapolated values should not change significantly with small variations in parameter values. This condition is necessary to avoid frequent changes of models and significant revisions that confuse the users of seasonally adjusted data.

The method must produce extrapolated values that follow the intra-year movement reasonably well although they could miss the level. This requirement reflects the fact that these projected values are not for policy or decision making but to improve current seasonal adjustment.

It must generate optimum extrapolated values in the minimum mean square error sense. This condition

allows the extrapolated values, at least the one lead extrapolation, to be used as benchmarks for preliminary data coming from incomplete returns.

The method must be parsimonious in the number of parameters. The main characteristics of the series are thus summarized in a small number of parameters.

This set of conditions led to the selection of a univariate method of forecasting and, among the several well developed methods, the ARIMA models (autoregressive integrated moving averages) of the Box and Jenkins (1970) type were chosen. ARIMA models have been found to be powerful forecasting procedures for a large class of series (Newbold and Granger, 1974; Reid, 1975).

ARIMA models bring together two basic concepts in extrapolating: autoregression and moving averages. ARIMA is an acronym with the first two letters, AR, standing for "Autoregressive"; the second two letters, MA, for "Moving Average" and the I, for "Integration", or summation. This part of ARIMA is indispensable since stationary models which are fitted to the differenced data have to be summed or "integrated" to provide models for the non-stationary data.

In the Box and Jenkins notation, the general multiplicative ARIMA model for a series with seasonality is expressed as $(p,d,q)(P,D,Q)_s$, where d is the order of the ordinary difference and D is the order of the seasonal differences applied to the original series in order to make it stationary. In other words, the statistical structure of the series must be independent of time; this implies model stability. To correct for a continuous change in level due to an upward or downward trend, a first difference (d=1) is applied to the original series Z_t; i.e., the new series is $W_t=Z_t-Z_{t-1}$. Symbolically, $W_t=(1-B)Z_t$, where B is the lag operator such that $B^nZ_t=Z_{t-n}$. For more complex cases of deterministic or stochastic instability, higher order differences are applied. To correct for a stable seasonality, the power of the seasonal difference, D, is made equal to one, and the transformed series is then $W_t=Z_t-Z_{t-s}=(1-B^s)Z_t$, where s is the seasonal periodicity, equal to 12 for monthly data and to 4 for quarterly data. Higher order seasonal differences remove other kinds of seasonal patterns.

p and P indicate the ordinary and the seasonal autoregressive order parameters respectively, in other words, the number of periods that Z_t is lagged. If p=1, the independent variable Z_t is lagged once, i.e., Z_{t-1}, if P equals 1, Z_t is also lagged once but in the seasonal periodicity, i.e, Z_{t-s}. These lagged variables are affected by autoregressive parameters ϕ and Φ respectively, which measure the impact of the previous observed value (month, quarter) and the previous year observed value for that month or quarter, on the dependent variable Z_t.

q and Q are the moving averages order parameters and indicate the number of periods that the observed residuals are lagged. If q=1, then the residuals a_t are lagged once; i.e., a_{t-1}, and if Q=1, the residuals a_t are also lagged once but in the seasonal periodicity, i.e., a_{t-s}. These lagged residuals are affected by the parameters θ and Θ respectively, which measure the impact of the residuals of the previous value (months, quarters) and of the previous year value for the month or quarter, on the dependent variable Z_t.

Thus for ARIMA models, the variable Z_t is a function of lagged dependent variables and of lagged residuals. For example, the simple ARIMA model $(0,1,1)(0,1,1)_4$ of Z_t reduces to,

$$(1-B)(1-B^4)Z_t = (1-\theta B)(1-\Theta B^4)a_t \qquad (1)$$

$$\text{or } Z_t = Z_{t-1} + Z_{t-4} - Z_{t-5} + a_t - \theta a_{t-1} - \Theta a_{t-4} + \theta\Theta a_{t-5} \qquad (2)$$

(2) says that Z_t is equal to the previous quarter value Z_{t-1} plus the difference between the values for the corresponding last year quarter and previous last year quarter, plus the present innovation and lagged residuals.

For a crude approximation θ can be interpreted as the extent to which residuals incorporate themselves in the subsequent history of the trend-cycle and Θ as the extent to which the residuals incorporate themselves in the subsequent seasonal pattern.

θ and Θ take values between zero and 1. When both are equal to one, the residuals have their maximum impact on the subsequent evolution of the series making the process deterministic. When both are equal to zero, the residuals have a transitory or instantaneous impact only and the process is strongly stochastic.

The procedure followed by model (1) to obtain an estimate of Z_t is not new to practicing statisticians who often use a very similar approach to get a projected value to compare with a figure being checked.

The values of the autoregressive parameters ϕ and Φ and of the moving average parameters θ and Θ vary for each series and, therefore, the ARIMA models are very flexible and can follow well the systematic movement of a large class of series.

The ARIMA extrapolating function can be expressed in different forms but for computational purposes the difference equation form is the most useful. For a detailed discussion of the properties and basic assumptions of ARIMA models the reader is referred to Box and Jenkins (1970), and Granger and Newbold (1977).

Section 3. The Selection of ARIMA Models

The ARIMA Automatic Option

The ARIMA models to be used in the context of the X-11-ARIMA method must fulfill the double condition of fitting the data well and of generating "reasonable" projections for the last three years of observed data. By "reasonable" projections is meant projections with a mean absolute error smaller than 5% for well-behaved series (e.g., Employment adult males) and smaller than 12% for highly irregular series (e.g., Unemployment teenage males).

These guidelines have been tested with more than 250 economic time series and are rather conservative. In fact, even with larger extrapolation errors, the X-11-ARIMA produces concurrent and forecast seasonals more reliable than those from X-11.

If possible, the identification of the ARIMA models should be made using data previously treated for extreme values. This recommendation is even more relevant if the outliers fall in the most recent years, in order to avoid the rejection of good models simply because the outliers will inflate the absolute average extrapolation error above the acceptance level of the guidelines.

To determine whether or not a model fits the data well, the portmanteau test of fit developed by Box and Pierce (1970) with the variance correction for small samples is used. The null hypothesis of randomness of the residuals is tested at a 10% level of significance and the estimated parameters are checked to avoid over-differencing.

Based on the above criteria for fitting and extrapolation, three ARIMA models were incorporated into the X-11 program in order to automate X-11-ARIMA. The user can supply his own model or choose the automatic option. The latter can be used for series that are at least five years long and the program automatically checks whether one of the three models passes the required guidelines. For series longer than 15 years, only the last 15 years will be used in the ARIMA fit and extrapolation. In the affirmative case, the model chosen is the one that gives the smallest average extrapolation error. Then the program automatically extends the unadjusted series, with one year of extrapolated data and seasonally adjusts.

In the event that none of the three models is found acceptable, a message is given indicating that extrapolated values have not been incorporated into the unadjusted series. Particularly for flow series such as imports, retail trade and others, which can be strongly affected by strikes and trading day variations, it is recommended that these sources of variation be removed from the series before using the automatic option or identifying the ARIMA model. The program offers an option where the extreme values of the series are replaced by the fitted values of the ARIMA model that passes the guidelines of acceptance, in a first run, and then the same model is resubmitted to the modified series to extrapolate. This option however does not modify extreme values that might be in the $2(p + Pxs + d + Dxs)$ observations at the beginning of the series. Thus for a $(0,1,1)$ $(0,1,1)_{12}$ monthly model, this means that no replacement of extreme values is made in the first 26 observations.

When the three automatic models are rejected, the user should determine whether the rejection is due to an extremely large average extrapolated error for one particular year only. If such is the case, the models printed in the program can still be considered good if the year in question has been an unusual one, for example, of a strong recession. The best model should then be resubmitted using the option corresponding to user's ARIMA model identification.

The automated option for multiplicative and log additive seasonal adjustments chooses from the following three ARIMA models: log $(0,1,1)$ $(0,1,1)_s$, log $(0,2,2)$ $(0,1,1)_s$ and $(2,1,2)$ $(0,1,1)_s$ and for the additive decomposition, from $(0,1,1)$ $(0,1,1)_s$, $(0,2,2)$ $(0,1,1)_s$ and $(2,1,2)$ $(0,1,1)_s$.

The selection of the three first models was made from a set of 12 ARIMA models testing **out of sample** extrapolated values, for the four last years, on 174 economic time series of 15 years of length and of quarterly and monthly observations.

The 12 models tested were:

1. $(1,1,1)$ $(1,1,1)_s$
2. $(2,1,2)$ $(0,1,1)_s$
3. $(2,0,1)$ $(0,1,2)_s$
4. $(1,1,2)$ $(0,1,2)_s$
5. $(2,0,0)$ $(0,1,1)_s$
6. $(1,1,2)$ $(1,0,2)_s$
7. $(2,1,1)$ $(0,1,2)_s$ log
8. $(0,1,2)$ $(1,1,2)_s$ log
9. $(0,1,1)$ $(0,1,1)_s$ log
10. $(0,1,1)$ $(0,2,2)_s$ log
11. $(0,2,2)$ $(0,1,1)_s$ log
12. $(2,1,1)$ $(0,1,1)_s$ log.

The 174 series were obtained from the following sectors: the System of National Accounts, Manufacturing, Prices, Labour, Construction, Domestic Trade, and Finance.

Originally, the models were ranked according to how well they fitted the series and met only two of the

criteria of acceptance, the χ^2 test of randomness at 1% and the absolute average forecasting error lower than 10% (Lothian and Morry, 1978.a). In further experimentations the χ^2 probability level was raised to to 10% and the absolute average forecasting error for the last three years to 12% (Dagum, 1979.a).

It was found that model 2 fitted and forecast well 73% of the series. For the class of series not passed by model 2, model 11 provided acceptable results for 19% of those remaining (or 5% of the total). For the remaining series not passed by either model 2 or model 11, model 9 showed the best performance, passing an additional 2% of the total number of series. Thus models 2, 11, and 9 jointly passed 80% of the series. An additional 1% could have been fitted by the other 9 models, while none of the 12 models tested provided acceptable results for the remaining 19% of the series.

The objective of an automatic procedure is to find adequate models for a great variety of series at minimal cost, i.e., have a small set of models that cover a large class of economic series.

The average forecast errors for each of the 174 series were ranked. It was found that when models 9 and 11 passed the guidelines, one of the two models often placed first among the 12 models. Due to this result only models 9 and 11 are fitted initially; model 2 is fitted only if neither 9 nor 11 pass the guidelines.

For a larger sample of 305 series and testing **within sample** extrapolated values for the same 12 models, it was found that the best three models were $(2,1,2)$ $(0,1,1)_s$, $(2,0,1)$ $(0,1,2)_s$ and log $(2,1,2)$ $(0,1,2)_s$ (Dagum, 1978.c.). The average **out of the sample** extrapolation error for this set of three models when testing the sample of 174 series was close to the average obtained by the other three models chosen and both sets passed the guidelines of acceptance. However, models 2, 9 and 11 have been preferred because they are more parsimonious in the number of parameters. Furthermore, one of the IMA type models, the log $(0,1,1)$ $(0,1,1)_s$ has a system of weights similar to those of the additive standard option of the X-11 program according to Cleveland and Tiao (1976). The need for the logarithmic transformation stems from the fact that the majority of the series tested followed a multiplicative relationship among the trend, cycle, seasonal and irregulars.

For those series seasonally adjusted additively, the automatic selection is made from the $(0,1,1)$ $(0,1,1)_s$, $(0,2,2)$ $(0,1,1)_s$ and $(2,1,2)$ $(0,1,1)_s$ non-log models. Although the first two models did not enter in the set of models originally tested, further experimentation with series that followed an additive relation among the components showed that the logarithmic transformation adversely affected both the average forecasting error and the χ^2 probability value. It is also apparent that when the additive option is used because of the presence of zeros or negative values in a series, the automatic option would test only the model $(2,1,2)$ $(0,1,1)_s$ if these changes had not been made. For further details on the model selection, evidences of overdifferencing, and new modifications from the first experiment, the reader is referred to Dagum (1979.a).

The extrapolation ARIMA option prints:

The tested models expressed in the classical form (p,d,q) $(P,D,Q)_s$ as described in Section 2 above.

The transformation performed on the data before testing the models.

The absolute average percentage error of the extrapolated values for each of the last three years and the average for the three years. If the average forecasting error (AFE) is greater than 12%, the ARIMA automatic option rejects the model.

The χ^2 probability for testing the null hypothesis of randomness of the residuals. If the χ^2 probability is smaller than 10%, the ARIMA automatic option rejects the model.

The coefficient of determination R^2.

The values of the estimated parameters in the following order: First, the ordinary autoregressive parameters ϕ the number of which is given by p; second, the seasonal autoregressive parameters Φ the number of which is given by P; third, the ordinary moving average parameters θ the number of which is given by q; and fourth, the seasonal moving average parameters, Θ the number of which is given by Q.

Evidences of overdifferencing are present if the sum of the ordinary moving average parameters or the seasonal moving average parameters, is greater than .90. In such case, the model is rejected.

If any of the three models of the automatic option passes the guidelines of acceptance, the program uses the best one to backcast one year. The backcasts are tested in similar manner except that the absolute average backcasting error must be greater than 18% to reject the model. This increase in the upper bound of acceptance is due to the fact that the extrapolation errors are all expressed in percentage of the level of the series, and for most series, their level has more than doubled during the last 10 years. Furthermore, for series of 11 years or more, the influence of the backcasts in the current seasonal factors is minor.

The program has also an option by which only forecasts are generated from the ARIMA model chosen.

The Identification of ARIMA Models by the User

The guidelines for the acceptance of an ARIMA model when using the automatic option are conservative. If the series fails these guidelines "marginally", the users

may still apply the best of the three models if it is considered satisfactory for the series in question. By marginally is meant here a χ^2 probability between 5% and 10%; and for highly irregular series, an average forecasting error between 12% and 15%. If none of the three selected models is marginally acceptable, the user should identify a new model. In many cases, the identification that lead to a good model requires minor changes to the automatic option's models. The following rules have been useful to improve the fitting and extrapolation for a large number of series.

Correcting for a low χ^2 probability. A low χ^2 probability indicates that the residuals of the fitted model are autocorrelated. This frequently happens because the log transformation is not needed (if applied) or vice versa. Resubmitting the model with the transformation changed may correct the low χ^2 value. In other cases this low χ^2 value is the result of overdifferencing and once this is corrected, as described below, the model becomes adequate.

Correcting for evidences of overdifferencing. Evidences of overdifferencing lead to cancellation of parameters suggesting a more parsimonious model. For example, if the estimated ordinary moving average parameters of the (0,2,2) $(0,1,1)_4$ model are $\theta_1 = 1.3$ and $\theta_2 = 0.3$, because their sum is greater than .90, the program will reject the model on the basis of evidences of overdifferencing. In effect, the (0,2,2) $(0,1,1)_4$ model can be written as:

$$(1-B)^2(1-B^4)Z_t = (1-1.3B + .3B^2)(1-\Theta B^4)a_t, \qquad (3)$$

where Θ is the seasonal moving average parameter and s=4 is the seasonal periodicity. The right hand member of (3) can be factored, as follows:

$$(1-1.3B + .3B^2)(1-\Theta B^4) = (1-B)(1-.3B)(1-\Theta B^4) \qquad (4)$$

substituting (4) into (3) and simplifying, it becomes,

$$(1-B)(1-B^4)Z_t = (1-0.3B)(1-\Theta B^4)a_t. \qquad (5)$$

The (5) is a (0,1,1) $(0,1,1)_4$ model. Because the estimation of the parameters is not exact, the model suggested by the parameter cancellation is not always the correct one. Often some modifications must be made. In our example, if the (0,1,1) $(0,1,1)_4$ model is not adequate, by simply adding an ordinary moving average parameter to compensate for the complete elimination of the ordinary differences (1–B), a good model can be obtained, e.g.; (0,1,2) $(0,1,1)_4$. Another common case of overdifferencing occurs when the seasonal moving average parameter Θ is $>$ .90. In such case, model (5) reduces to:

$$(1-B)Z_t = (1-0.3B)a_t, \qquad (6)$$

that is, a (0,1,1) model. The cancellation suggests that: seasonality is not present; or seasonality, if present, is mostly of a **deterministic** character. In the first case, further evidence can be obtained by looking at the tests for presence of seasonality available in the X-11-ARIMA program. If these tests indicate that seasonality is present, the user can try a simpler model with only seasonal moving average parameter, say (0,1,1) (0,0,1) to generate the extrapolated values. Whether the ARIMA option is applied or not, it is recommended that the seasonal adjustment be made using the moving averages for stable seasonality.

Correcting for high extrapolation errors. Generally, having corrected for the low χ^2 probability and/or evidences of overdifferencing, the extrapolation errors are reduced. However, if such is not the case, users should identify their own model using any computer program for ARIMA model identification and estimation. The versions called APCORR for model identification and TYMPAC for model estimation can be requested from the Seasonal Adjustment and Time Series Staff, at Statistics Canada.

Section 4. Basic Properties of the X-11-ARIMA Moving Averages

Main Steps in Producing a Seasonally Adjusted Series

The main steps in producing seasonally adjusted series using the X-11-ARIMA method are equal to those of Method II-X-11 variant (Shiskin, Young and Musgrave, 1967) as shown in Appendix A. The main differences are: (i) the extension of the unadjusted series with one year of extrapolated values from ARIMA models at one or both ends of the series whenever the ARIMA option is used; (ii) the option of applying a centred 24-term moving average for the preliminary estimation of the trend-cycle; (iii) short series of three and four years are seasonally adjusted only with the stable seasonality option.

The X-11 ARIMA assumes that the main components of a time series follow a multiplicative, an additive, or a log additive model, that is

1. $0_t = C_t S_t I_t$ (multiplicative model)
2. $0_t = C_t + S_t + I_t$ (additive model)
3. $\log 0_t = \log C_t + \log S_t + \log I_t$ (log additive model)

where 0_t stands for the unadjusted series, C_t the trend-cycle, S_t the seasonal and I_t the irregular.

The estimation is made with different kinds of moving averages that are applied sequentially in 13 steps repeated twice.

For the standard option of the computer program these 13 steps are:

1. Compute the ratios between the original series and a centred 12-term moving average (2 x 12 m.a., that is a 2-term average of a 12-term average) as a first estimate of the seasonal and irregular components (SI).
2. Apply a weighted 5-term moving average (3 x 3 m.a.) to the seasonal-irregular ratios (SI) of each month separately, to obtain a preliminary estimate of the seasonal factors.

3. Compute a centred 12-term moving average of the preliminary factors in 2 for the entire series. To obtain the six missing values at either end of this average, repeat the first (last) available moving average value six times. Adjust the factors to add to 12 (approximately) over any 12-month period by dividing the centred 12-term average into the factors.
4. Divide the seasonal factor estimates into the seasonal irregular (SI) ratios to obtain an estimate of the irregular component.
5. Compute a moving five-year standard deviation (σ) of the estimates of the irregular component and test the irregulars in the central year of the five-year period against 2.5σ. Remove values beyond 2.5σ as extreme and recompute the moving five-year σ. Assign a zero weight to irregulars beyond 2.5σ and a weight of 1 (full weight) to irregulars within 1.5σ. Assign a linearly graduated weight between 0 and 1 to irregulars between 2.5σ and 1.5σ.
6. For the first two years, the σ limits computed for the third year are used; and for the last two years, the σ limits computed for the third-from-end year are used. To replace an extreme ratio in either of the two beginning or ending years, the average of the ratio times its weight and the three nearest full-weight ratios for that month is taken.
7. Apply a weighted 5-term moving average to the SI ratios with extreme values replaced, for each month separately, to estimate preliminary seasonal factors.
8. Repeat step 3, applied to the factors found in step 7.
9. To obtain a preliminary seasonally adjusted series divide 8 into the original series.
10. Apply a 9-, 13-, or 23-term Henderson moving average to the seasonally adjusted series and divide the resulting trend-cycle into the original series to give a second estimate of the SI ratios. (In the first iteration, only the 13-term Henderson is applied.)
11. Apply a weighted 7-term moving average (3 x 5 m.a.) to each month's SI ratios separately, to obtain a second estimate of the seasonal component.
12. Repeat step 3.
13. Divide 11 into the original series to obtain the seasonally adjusted series.

Allan Young (1968), using a linear approximation of the Census Method II, arrives at the conclusion that a 145-term moving average is needed to estimate one seasonal factor with central weights if the trend-cycle component is adjusted with a 13-term Hernderson moving average. The first and last 72 seasonal factors (six years) are estimated using sets of asymmetrical end weights. It is important to point out, however, that the weights given to the more distant observations are very small and, therefore, this moving average can be very well approximated by taking one half of the total number of terms plus one. So, if a 145-term moving average is used to estimate the seasonal factor of the central observation, a good approximation is obtained with only 73 terms, i.e., six years of observations. The properties of the filters used in the Method II-X-11 program are extensively discussed in Dagum (1976.a and 1978.b) and the stochastic properties for data filtering of X-11-ARIMA are analyzed in Dagum (1979.c). A brief discussion is made here for monthly series but the conclusions are also valid for quarterly series.

Basic Properties of the Two-sided Linear Smoothing Filters (Central Weights) of the X-11-ARIMA

The linear smoothing filters applied by Method II-X-11 and the X-11-ARIMA to produce seasonally adjusted data can be classified according to the distribution of their set of weights into symmetric (two-sided) and asymmetric (one-sided). The symmetric moving averages are used to estimate the component values that fall in the middle of the span of the average, say $2n + 1$, and the asymmetric moving averages, to the first and last n observations. The sum of the weights of both kinds of filters is one and thus the mean of the original series is unchanged in the filtering process.[1]

It is very important in filter design that the filter does not displace in time the components of the output relative to those of the input; in other words, the filter must not introduce phase shifts.[2] Symmetric moving averages introduce no time displacement for some of the components of the original series and a displacement of $\pm 180^\circ$ for others. A phase shift of $\pm 180^\circ$ is interpreted as a reverse in polarity which means that maxima are turned into minima and vice versa. In other words, peaks (troughs) in the input are changed into troughs (peaks) in the output.

For practical purposes, however, symmetric moving averages act as though the time displacement is null. This is so because the sinusoids that will have a phase shift of $\pm 180^\circ$ in the filtering process are cycles of short periodicity (annual or less) and moving averages tend to suppress or significantly reduce their presence in the output.

The centred 12-term moving average. The centred 12-term moving average is used for a preliminary estimate of the trend-cycle (step 1). This filter reproduces exactly the central point of a linear trend and annihilates a stable seasonality over a 13-month period in an additive model. If the relationship among the components is multiplicative, then only a constant trend multiplied to a stable seasonality will be perfectly reproduced.

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1 The sum of the weights of a filter determines the ratio of the mean of the smoothed series to the mean of the unadjusted series assuming that these means are computed over periods long enough to ensure stable results.

2 In spectral analysis, the phase is a dimensionless parameter that measures the displacement of the sinusoid relative to the time origin. Because of the periodic repetition of the sinusoid, the phase can be restricted to $\pm 180^\circ$. The phase is a function of the frequency of the sinusoid, the frequency being equal to the reciprocal of the length of time or period required for one complete oscillation.

The main limitation of this filter is that it misses peaks and troughs of short cycles (three or two years) and unless the irregular variations are small, it will not smooth the data successfully. If the input to this filter is a sine curve of three-year periodicity and amplitude 100, the output is a sine curve of equal periodicity but with amplitude reduced to 82.50; the amplitude of sine waves of two-year periodicity is reduced to 75; and only sine waves of five years or more are passed with very small reductions in their amplitudes. However because the trend-cycle variation of most economic time series is mainly due to long cyclical variations of 40 months or more (Davis, 1941), this filter is generally good for a preliminary estimation of the trend-cycle.

The centred 24-term moving average. For series mostly dominated by short cyclical fluctuations (three or two years) or affected by sudden changes in trend level, an optional centred 24-term filter is included in X-11 ARIMA. This filter is a modified version (Cholette, 1979) of the Leser filter (1963).

The amplitude of sine waves of three- and two-year period are reduced by only 5% and 18% respectively.

Furthermore, it eliminates the irregular variation more than the centred 12-term filter. Unfortunately, as we depart from the central observation, the estimation of the 12 points at each side deteriorates gradually. Because of this, in X-11-ARIMA the asymmetric weights that estimate only the six points at each side of the central observation are used. The first and last six observations are deleted as in the centred 12-term filter. These asymmetric weights applied to observations 7 to 12 and 14 to 19 share the same spectral properties of the centred 24-term filter except for small phase shifts.

The 9-, 13- and 23-term Henderson moving averages. The Henderson moving averages were developed by summation formulae mainly used by actuaries. The basic principle for the summation formulae is the combination of operations of differencing and summation in such a manner that when differencing above a certain order is ignored, they will reproduce the functions operated on. The merit of this procedure is that the smoothed values thus obtained are functions of a large number of observed values whose errors, to a considerable extent, cancel out. These filters have the properties that, when fitted to second or third degree parabolas, their output will fall exactly on those parabolas and, when fitted to stochastic data, they will give smoother results than can be obtained from the weights which give the middle point of a second degree parabola fitted by least squares. Recognition of the fact that the smoothness of the resulting filtering depends on the smoothness of the weight diagram led Robert Henderson (1916) to develop a formula which makes the sum of squares of the third differences of the smoothed series a minimum for any number of terms.

The Henderson moving averages are applied to obtain an improved estimate of the trend-cycle (step 10). They give the same results as would be obtained by smoothing the middle values of a third degree parabola fitted by weighted least squares, where the weights given to the deviations are as smooth as possible.

The fact that the trend-cycle is assumed to follow a parabola over an interval of short duration (between one and two years approximately) makes these filters very adequate for economic time series.

None of the Henderson filters used by the X-11-ARIMA program eliminates the seasonal component but since they are applied to data that are already seasonally adjusted, this limitation becomes irrelevant. On the other hand, they are extremely good for passing sines of any period longer than a year. Thus, the 13-month Henderson, which is the most frequently used, will not reduce the amplitude of sines of period 20 months or more, which stand for trend-cycle variations. Moreover, it eliminates almost all the irregular variations that can be represented by sines of very short periodicity, six months or less.

The weighted 5-term (3 x 3) and the weighted 7-term (3 x 5) moving averages. The weighted 5-term moving average is a 3-term moving average of a 3-term moving average (3 x 3 m.a.). Similarly, the weighted 7-term moving average is a 3-term moving average of a 5-term moving average (3 x 5 m.a.). These two filters are applied to the seasonal-irregular ratios (or differences) for each month, separately, over several years. Their weights are all positive and, consequently, they reproduce the middle value of a straight line within their spans. This property enables the X-11-ARIMA program to estimate a linearly moving seasonality within five- and seven-year spans. Therefore, these filters can approximate quite adequately gradual seasonal changes that follow non-linear patterns over the whole range of the series (more than seven years).

The weighted 5-term moving average (3 x 3 m.a.) is a very flexible filter that allows for fairly rapid changes in direction, but since the span of the filter is short, the irregulars must be small for the SI to be smoothed successfully.

The weighted 7-term moving average (3 x 5 m.a.) is less flexible and it is applied for the final estimate of the seasonal factors. For series whose seasonal factors are nearly stable, this program also provides other optional sets of weights which are applied to longer spans and thus produce smoother seasonal-irregular ratios.

Basic Properties of the One-sided Smoothing Filters (End Weights) of the X-11-ARIMA Method

It is inherent in any moving-average procedure that the first and last **n** points of an unadjusted series cannot be smoothed with the same set of symmetric weights applied to middle values. In the X-11-ARIMA the seasonal adjustment of current years and the seasonal factor forecasts are obtained from the combination of two filters: (i) the one-sided filters used for extrapolating the unadjusted data from the ARIMA models and (ii) the filters of the X-11 program used for seasonal

adjustment. The extrapolation filters of the ARIMA models change with the series and are therefore very flexible. These filters reflect the most recent movements of the series, in particular, rapidly changing seasonality.

The X-11 filters applied to the **extended** unadjusted series for the trend-cycle estimation are two-sided. Therefore they do not miss turning points and do not introduce phase shifts, which allows them to estimate the cyclical variations well.

The X-11 filters that estimate the seasonal factors are still one-sided but closer to the symmetric filters used for central observations. Thus, with one year of extrapolated data, the seasonal factor forecasts are obtained from the extrapolated data with the X-11 filters used for producing concurrent seasonal adjustment.

It is the combination of the fixed filters from X-11 (the same for any series) with the flexible filters of the ARIMA models (changing with the series) that makes X-11-ARIMA a better method than X-11 for current adjustment.

Section 5. The Advantages of X-11-ARIMA Over Method II-X-11 Variant

The main advantages of X-11-ARIMA over the X-11 variant are:

1. The availability of a statistical model that provides relevant information on the quality of the raw data. The existence of a model that fits the original series, even though it does not pass the guidelines for extrapolation, warrants the fulfilment of the fundamental principle of seasonal adjustment, that is, the series is decomposable. In other words, if a series does not lend itself to the identification of an ARIMA model (including any type AR, MA, ARIMA) which simply describes the series as a function of past values and lagged random disturbances, any decomposition into trend-cycle, seasonal and irregulars can be seriously criticized and of doubtful validity. In fact, the lack of fit by an ARIMA model can indicate deficiencies concerning the way in which the observations are made, e.g., improper sampling interval.

   If the series has an ARIMA model, the expected value and the variance of the original series can be calculated and thus, confidence intervals can be constructed for the observations. This enables the identification of extreme values, particularly at the end of the series.

2. The one-step extrapolation from ARIMA models is a minimum-mean-square-error extrapolation and can be used as a projected value or benchmark for preliminary figures.

3. If concurrent seasonal factors are applied to obtain current seasonally adjusted data, there is no need to revise the series more than twice. For many series, one revision alone will give seasonal factors that are "final" in a statistical sense.

4. The total error in the seasonal factor forecasts and in the current seasonal factors is significantly reduced for all the months. Generally, a reduction of some 30% in the bias and of 20% in the absolute value of the total error has been found for Canadian and American series.

   There are several reasons for the significant reduction of the error in the seasonal factor forecasts and concurrent seasonal factors. The X-11-ARIMA produces seasonal factor forecasts from the combination of two filters: (i) the filters of the autoregressive integrated moving averages (ARIMA) models used to extrapolate the raw data; and (ii) the filters that Method II-X-11 variant applies to obtain the first revised seasonal factors. In this manner, the seasonal factor forecasts are obtained from the extrapolated raw values with a set of moving averages whose weights, though still asymmetric, are closer to the weights applied to central observations as compared to the forecasting function of the X-11 variant.

5. Another advantage of X-11-ARIMA is that the trend-cycle-estimate for the last observation is made with the symmetric weights of the Henderson moving averages (which can reproduce a cubic in their time span) combined with the weights of the ARIMA model used for the extrapolated data. Since these latter weights change with the ARIMA model fitted to the series, they reflect the most recent movements and a better trend-cycle estimation is obtained from the combined weights. This is particularly true for years with turning points because the X-11 applies the asymmetric weights of the Henderson filters which can adequately estimate only a linear trend.

6. Finally, by adding one or two more years of extrapolated data (with no extremes, since they are mere projections) a better estimate of the variance of the irregulars is obtained. The latter allows a significant improvement in the identification and replacement of outliers which, as is well known, can severly distort the estimates obtained with linear smoothing filters. For concurrent seasonal factors, the same observations are valid except that the seasonal filters are closer to the central filters than those corresponding to the seasonal factor forecasts. For this reason, the number of revisions in the seasonal factor estimates is also significantly reduced. It was found that one year of forecasts and backcasts is the best compromise for the majority of the series when using the automated option.

Section 6. Other Main Improvements Incorporated Into the Automated Version of the X-11-ARIMA

A set of new statistical tests, tables and graphs have been incorporated into the present automated version of the X-11-ARIMA besides the automatic selection of the ARIMA models, as discussed earlier in Section 3 of this chapter. These tests are used to assess the quality

of the original series and the reliability of the seasonal adjustment. A brief description of these improvements follows:

An F Test for the Presence of Seasonality in Table B1

This test is based on a one-way analysis of the variance on the SI ratios (differences) similar to the one already available in Method II-X-11 variant for the presence of stable seasonality in Table D8. It differs only in that the estimate of the trend-cycle is made directly from the original series by a centred 12-term moving average. The estimate of the trend-cycle is removed from the original series by division into (subtraction from) the raw data for a multiplicative (additive) model.

The value of the F ratio is printed in Table B1. The F is a quotient of two variances: (i) the "between months or quarters" variance which is mainly due to the seasonals and (ii) the "residual" variance which is mainly due to the irregulars.

Since several of the basic assumptions in the F test are probably violated, the value of the F ratio to be used for rejecting the null hypothesis, i.e., no significant seasonality present, is tested at the one per thousand probability level.

A Test for the Presence of Moving Seasonality in Table D8

The moving seasonality test is based on a two-way analysis of variance performed on the SI ratios (differences) from Table D8 (Higginson, 1975). It tests for the presence of moving seasonality characterized by gradual changes in the seasonal amplitude but not in the phase.

The total variance of the SI ratios (differences) is considered as the sum of the:

1. σ_m^2, the "between months or quarters" variance which primarily measures the magnitude of the seasonality. It is equal to the sum of squares of the difference between the average for each month of the SI and the total average, corrected by the corresponding degrees of freedom.
2. σ_y^2, the "between years" variance which primarily measures the year-to-year movement of seasonality. It is equal to the sum of squares of the differences between the annual average of the SI for each year and the total average of the SI for the whole table corrected by the corresponding degrees of freedom.
3. σ_r^2, the "residual" variance which is equal to the total variance minus the "between months or quarters" variance and the "between years" variance.

The F ratio for the presence of moving seasonality is the quotient between the "between years" variance and the "residual" variance.

To calculate the variance in an additive model the absolute values of S + I are used, otherwise the annual average is always equal to zero. For a multiplicative model, the SI ratios are replaced by absolute deviations from 100, i.e., by $|SI\text{-}100|$. Contrary to the previous test, for which a high value of F is a good indication of the presence of measurable seasonality, a high value of F corresponding to moving seasonality reduces the probability of a reliable estimate of the seasonal factors. The F test is printed in Table D8 indicating whether moving seasonality is present or not.

A Combined Test for the Presence of Identifiable Seasonality in Table D8

This test combines the previous test for the presence of moving seasonality with the F test for the presence of stable seasonality and the Kruskal-Wallis chi-squared test (another non-parametric test for the presence of stable seasonality).

The main purpose of this test is to determine whether the seasonality of the series is "identifiable" or not. For example, if there is little stable seasonality and most of the process is dominated by rapidly moving seasonals, chances are that the seasonals will not be accurately estimated for they will not be properly identified by the X-11-ARIMA method.

The test basically consists of combining the F values obtained from the three previously prescribed tests as follows:

1. If the F_S–test for the presence of stable seasonality at the 0.1% level of significance fails, the null hypothesis, i.e., seasonality is not identifiable, is accepted.
2. If (1) passes but the F_M test for the presence of moving seasonality at the 5% level of significance fails, then this F_M value is combined with the F_S value from (1) to give $T_1 = \frac{7}{F_M - F_S}$ and $T_2 = \frac{3F_M}{F_S}$ and a simple average of the two T's is calculated. If this average is greater than or equal to one, the null hypothesis, i.e, identifiable seasonality not present, is accepted.
3. If the F_M test passes but one of the two T's statistics fails, or the Kruskal-Wallis test fails at the 1% level, then the program prints "identifiable seasonality probably present".
4. If the F_S, F_M and the Kruskal-Wallis chi-square values pass, then the null hypothesis (of identifiable seasonality not present) is rejected. The program prints "identifiable seasonality present".

The messages are printed at the end of Table D8.

For further details, the reader is referred to Lothian and Morry (1978.b).

A Test for the Presence of Residual Seasonality in Table D11

This is an F test applied to the values of Table D11 and calculated for the whole length of the series as well as for the last three years. The effect of the trend is removed by a first-order difference of lag three for monthly series and lag one for quarterly series, that is, $\hat{O}_t - \hat{O}_{t-s/4}$ where $\hat{O}_t$ are the values of Table D11. Two F ratios are printed at the end of the table as well as a message indicating the presence or absence of residual seasonality for the last three years and the whole length of the series (Higginson, 1976).

The Normalized Cumulative Periodogram Test for the Randomness of the Residuals

The Method II-X-11 variant uses the Average Duration of Run (ADR) statistic to test for autocorrelation in the final estimated residuals obtained from Table D13. This non-parametric test was developed by W.A. Wallis and G.H. Moore (1941), and is constructed on the basis of the number of turning points. It is efficient for testing the randomness of the residuals only against the alternative hypothesis that the errors, I_t, follow a first-order autoregressive process of the form $I_t = \rho I_{t-1} + e_t$ where ρ is the autocorrelation coefficient and e_t is a purely random process.

If a process is purely random and we have an infinite series, the ADR statistic is equal to 1.50. For a series of 120 observations, the ADR will fall within the range 1.36 and 1.75 with a 95% confidence level. Values greater than 1.75 indicate positive autocorrelation and values smaller than 1.36 indicate negative autocorrelation.

This test, however, is not efficient for detecting the existence of periodic components in the residuals, which can happen when relatively long series are seasonally adjusted or when the relative variation of the seasonal component is small with respect to that of the irregular. To test independence of the residuals against the alternative hypoethesis implying periodic processes, the normalized cumulative periodogram has been incorporated in the X-11-ARIMA program.

The normalized cumulative periodogram values are given in a table and also in a graph. By visual inspection it is possible to determine if components with certain periodocity are present or not in the irregulars.

If the residuals are the estimates of a sample realization of a purely random process, and if the size of the sample tends to infinity, then the normalized cumulative periodogram tends to coincide with the diagonal of the square in which it is drawn.

Deviations of the periodogram from the line expected if the residuals were purely random can be assessed by use of the Kolmogorov-Smirnov test. This test is useful to determine the nature of hidden periodicities left in the irregulars, whether of seasonal or cyclical character and complements the information provided by the test for the presence of residual seasonality. (A simple explanation of this test is given in Dagum, Lothian and Morry, 1975.)

A New Table D11A Where the Annual Totals of the Seasonally Adjusted Values are Equal to the Annual Totals of the Raw Data

This new Table D11A produces a modified seasonally adjusted series where the annual totals of the seasonally adjusted values and the raw data are made equal.

The discrepancy between both annual totals is distributed over the seasonally adjusted values of Table D11 in a way that preserves the month-to-month or quarter-to-quarter movements of the unmodified seasonally adjusted series. The procedure is based on a quadratic minimization of the first differences of the annual discrepancies expressed as differences or ratios. For further details the reader is referred to Huot (1975) and Cholette (1978).

A Set of Quality Control Statistics

The statistics Canada X-11 version as developed in 1975 had two statistics called Q_1 and Q_2 that provided an indication of the amount and nature of the irregulars and the seasonal components respectively. These statistics and their basic assumptions are discussed by Huot and de Fontenay (1973).

Considerable research has been carried out since the first set of guidelines was developed and they are now reduced to only one Q statistic which results from the combination of several other measures (Lothian and Morry, 1978.c). Most of them are obtained from the summary measures of Table F2. Their values vary between 0 and 3, and only values less than one are considered acceptable. The statistics that are combined to produce the final Q- statistic follow:

1. The relative contribution of the irregulars over three-month spans as obtained from Table F2B denoted by M_1.
2. The relative contribution of the irregular component to the stationary portion of the variance as obtained from Table F2F; denoted by M_2.
3. The value of the I/C ratio (the ratio of the average absolute month-to-month or quarter-to-quarter per cent change in the irregular to that in the trend-cycle) for the selection of the Henderson moving averages in Table D7 printed in Table F2E; denoted by M_3.
4. The value of the average duration of run for the irregulars from Table F2D denoted by M_4.

5. The MCD or QCD (the number of months or quarters it takes the average absolute change in the trend-cycle to dominate the average absolute change in the irregular) from Table F2E denoted by M_5.
6. The total I/S moving seasonality ratio obtained as an average of the monthly moving seasonality ratios from Table D9 denoted by M_6. (It is the ratio of the average absolute year-to-year per cent change in the irregulars to that in the seasonals.)
7. The amount of stable seasonality in relation to the amount of moving seasonality, from the tests of Table D8, printed in Table F2I; denoted by M_7.
8. A measure of the year-to-year variation of the seasonal component for the whole series from Table D10 denoted by M_8.
9. The average linear movement of the seasonal component for the whole series from table D10 denoted by M_9.
10. Same as 8 but calculated for recent years only; denoted by M_{10}.
11. Same as 9 but calculated for recent years only; denoted by M_{11}.

New Tables

Two Tables, B20 and C20, produce the extreme values from the decomposition of the irregulars I' of Table B13 and Table C13, given the final weights W of Table B17 and Table C17 respectively. For additive models the extreme values are equal to $I'(1-W)$ and for multiplicative models they are equal to $I'/(1+W(I'-1))$.

A new Table D16 gives the total effect due to both the trading-day factors and the seasonal factors.

New Charts

The following new charts are available:

G1 chart that plots the values of the original series as in A1 or, in B1 if prior modifications are made, together with the backcasts and forecasts generated from the ARIMA option. It also plots the values of the original series as modified for extreme values from Table E1.

G6 graph corresponding to the Cumulative Periodogram test for the randomness of the residuals.

A Logarithmic Model

A new option allows the user to decompose the original series in an additive relation using the logarithms of the components. It is the additive equivalent of the multiplicative model (Lothian, 1978).

Other Features of X-11-ARIMA

1. In Method II-X-11 variant the end of the series is not treated in the same manner as the beginning, and seasonally adjusting the data in reverse time order does not give the same results as the original series. This is due to a nonhomogenous effect in the identification of the extremes. This effect is not present in the X-11-ARIMA program.
2. A new F3 table is introduced containing the new monitoring and quality control statistics.
3. Images of the main control and ARIMA cards are printed on the title page.
4. In the F2 table, several new summary measures statistics are introduced. For monthly series the first 14 autocorrelations of the final irregular are calculated (the first six for quarterly series). The approximate contribution of the components to the stationary portion of the variance is given. (The series is made stationary by removing a linear trend for additive models and an exponential trend for multiplicative models.) The results of all the analysis-of-variance tests in the program are printed with their associated probability values. The I/C ratio from Table D12 is printed.
5. The probability values for the normal, chi-squared, F, and t values are printed.
6. A variable trend-cycle routine that includes the 5- and 7-term Henderson filter and prior adjustment are available in the quarterly program.
7. If there is prior adjustment, except by trading-day factors, the D11 table equals Table A1 divided by Table D10 for the multiplicative version and equals A1 minus D10 for the additive version.
8. If the MCD (or QCD) is an even number, the MCD moving average is centred by taking an average of two MCD moving averages.
9. Two new printout options. These are a brief printout which prints only three to five tables and an analysis printout.
10. The quality control statistics for each series adjusted are collected and printed at the end of the printout. This allows users to quickly judge the acceptability of all series adjusted.
11. New input and output data formats were added. New formats for the prior adjustment factors were added.
12. The number of decimals of the input data no longer controls the number of decimals on the printout. The decimals on the printout are controlled by a separate option.
13. If the data is read from tape (or disk), the user can select an option which allows the program to search the tape for the series with the required series identifier. Another option will rewind the tape and search.
14. All weights for the moving averages (except the end weights for the Henderson) are calculated using their explicit formulae.

Chapter II

THE SEASONAL ADJUSTMENT OF COMPOSITE SERIES

By composite series is here understood a series that results from the addition, subtraction, multiplication and/or division of several components. These components series can enter into the composite with equal or different weights. Because of non-linearities involved in the process of composing the series by multiplication and division and/or in their seasonal adjustment method, the direct and indirect seasonally adjusted composites are usually different. The direct seasonal adjustment consists of making the composite of the unadjusted components, and then seasonally adjusting the composite series. The indirect seasonal adjustment consists of first seasonally adjusting the component series and then the seasonally adjusted composite series is obtained by implication. In order to decide whether the composite series should be seasonally adjusted using the direct or the indirect procedure the criterion of smoothness is often used. A classical measure of the degree of roughness or lack of smoothness in a seasonally adjusted composite series is the sum of squares of the first difference of the series. That is:

$$R_1 = \sum_t (\hat{X}_t - \hat{X}_{t-1})^2 \qquad (7)$$

where $\hat{X}_t$ is the series in question. The larger R_1 the rougher the series $\hat{X}$ or, equivalently the less smooth. The rationale of this measure is that the first difference filter removes most of the variations of long periodicities (trend and cycle). Lothian and Morry (1977) have found that the R_1 measure is related to the magnitude of the revisions in the seasonally adjusted series. The implicit definition of smoothness of R_1, however, excludes cycles of short periodicities and to compensate for this a new measure of roughness R_2 based on the 13-term Henderson filter is given in Dagum (1979). The R_2 measure is:

$$R_2 = \sum_t (\hat{X} - H\hat{X}_t)^2 = \sum_t \left[(I-H)\,\hat{X}_t\right]^2 \qquad (8)$$

where I–H is the complement of the Henderson filter.

These two measures, expressed as averages and, in percentages when the composition is multiplicative, have been incorporated in the X-11-ARIMA program used for the direct and the indirect seasonal adjustment of composite series. Generally, both measures give consistent results in favouring one procedure over the other from the viewpoint of smoothness. However, this consistency is not present when the composite series are strongly affected by cyclical variations of short periodicity and, in such cases, R_2 should be preferred in deciding which of the two procedures gives the smoothest seasonally adjusted data.

Chapter III

THE USER'S MANUAL OF THE X-11-ARIMA COMPUTER PROGRAM

This user's manual is divided into Parts A, B, C and D. Part A describes the control cards and inputs for the seasonal adjustment of single series by the X-11-ARIMA method. Part B describes the control cards and input for the seasonal adjustment of composite series that result from adding, subtracting, multiplying and/or dividing the component series. Part C is the file description for the X-11-ARIMA Program and Part D gives the sample printouts.

Part A. The X-11-ARIMA Seasonal Adjustment Control Cards and Inputs (Mandatory)

There are 11 types of control cards and inputs for the X-11-ARIMA program if no compositing is done. Four of these types are **mandatory** (1, 8, 9 and 11) for the processing of each series while the other seven types of input cards are **optional.** The type and order of the 11 control cards and inputs are:

Section

1. The Main Monthly or Quarterly Control Card (Mandatory)
2. The Extra Options Control Card (Optional)
3. The ARIMA Control Card for User Supplied Model (Optional)
4. User Supplied Format Card for the Unadjusted Series (Optional)
5. User Supplied Format Card for the Prior Adjustment Factors (Optional)
6. The Special Output Control Card(s) (Optional)
7. User Supplied Format Card for the Special Output (Optional)
8. The Title Card(s) (Mandatory)
9. The Unadjusted Data Cards (Mandatory)
10. The Prior Adjustment Data Cards (Optional)
11. The End of Run Card (Mandatory).

Part A is divided into 11 sections corresponding to the 11 types of inputs. Sections 1, 8, 9 and 11 will enable the user to run the standard versions of the program. If the user is interested in applying different seasonal curves for different months, or different trend-cycle curves for preliminary adjustment or other extra options, Section 2 should be read. If the user is interested in running a non-standard ARIMA model, Section 3 should be read. If the input data is in a non-standard format, Section 4 should be read. If a prior monthly or quarterly adjustment is required and the prior input data is in a non-standard format, Section 5 should be read. If the user requires any of the tables in X-11-ARIMA reproduced in machine-readable form, Section 6 should be read and if these tables are required in a non-standard format, Section 7 should be read. If prior monthly or quarterly adjustment is required, Section 10 should be read.

Section 1. The Main Monthly or Quarterly Control Card (Mandatory)

There are two types of main control cards, a monthly version and a quarterly version. The two types are mutually exclusive and the user should refer to Part A.1 if interested in doing a monthly adjustment and Part A.2 if interested in a quarterly adjustment. Both types of cards are divided into a data description section and an option section. Columns 1 and 2 and 11 to 22 contain data description information and all the information for this section **must** be supplied. Columns 23 to 80 contain information on possible options available in the program. All these columns can be left blank and the user will obtain a standard multiplicative seasonal adjustment without ARIMA extrapolation. The user should read the option section to select, among others, ARIMA extrapolation, strike adjustments, trading-day adjustments, different moving averages or longer printouts. Basically, the two types of main control cards are similar except an "M" is inserted in column 1 for a monthly adjustment and a "Q" is inserted in column 1 for a quarterly adjustment.

PART A.1. Monthly Seasonal Adjustment Control Card

Data Description Section (Mandatory)

Card Column	Punch	Description	
1		**CONTROL CARD IDENTIFIER**	
	M	Monthly seasonal adjustment.	
2		**INPUT FORMAT CONTROL**	
	Blank	Year and identifier on the right, data in 6-digit fields.	**FORTRAN FORMAT** (12F6.0,I2,A6)
	1	User supplied format	A **FORTRAN FORMAT** card describing the data areas only is required after the main X-11-ARIMA control card. See Section 4 of this part.
	2	Year and Identifier on the right of 2nd card (two cards per year), data in 12-digit fields.	**FORTRAN FORMAT** (6F12.0, /, 6F12.0, I2,A6)
	3	**STC Standard Format**	
		Identifier and year on the left (monthly series), data in 6-digit fields.	**FORTRAN FORMAT** (A6,I2,12F6.0)
	4	Tape or disk in CANSIM data base utility format, data in 16-digit fields.	**FORTRAN FORMAT** (A8,I2,10X,12E16.10,18X)
	5	Identifier and year on the left on the first of two cards (two cards per year), data in 12-digit fields.	**FORTRAN FORMAT** (A6,I2,6F12.0,/,8X,6F12.0)
3 - 10	Any	**Series Identification Code** may be numeric, alphabetic, or mixed; must be identical to series identifier on data cards. The series identifier must be **left** justified, i.e., if the data records have a six-column identifier, punch it in columns 3 to 8 inclusive.	
11 - 12	01 - 12	Number of the month in which series start, i.e., 01 for January, 02 for February, . . ., 12 for December. The first entry on the first data card must be made in the field corresponding to the month entered here. Thus if the series begins in March, the first two data fields on the first data card must be blank.	
13 - 14	00 - 99	Last two digits of the year in which the series starts. This date must be the same as the year punched on the first data card for this series. The first two digits of the year, in this field and all others calling for a year entry, are assumed to be 19.	
15 - 16	01 - 12	Number of the month in which the series ends.	
17 - 18	00 - 99	Last two digits of the year in which the series ends. This date must be the same as the year punched on the last data card for this series.	
19		**Number of Decimals on Input Cards.** This option can be used to modify input formats 0, 2, 3 and 5 in column 2 on the card. This option will have no effect on input formats 1 and 4.	
	Blank	No decimals.	
	1	1 decimal.	
	2	2 decimals.	
	3	3 decimals.	
	4	4 decimals.	
	5	5 decimals.	
20		**Tape or Disk Input**	
	Blank	Input Data on cards.	
	1	Input Data on tape or disk.	
	2	Input data on tape or disk and the tape is rewound before reading.	
	3	Input data on tape or disk and concatenated input files can be read.	
21		**Special Output** (Card, Tape, Disk, etc.).	
	Blank	No special output.	
	1	Special output. If this option is selected, a control card describing the special output must follow this card. See Section 6 of Part A.	

Data Description Section (Mandatory) – Concluded

Card Column	Punch	Description
22	0-5	**Number of Decimals on Output Tables.** All tables will be printed with the number of decimals entered here. In the multiplicative version trading-day adjustment factors on Tables C16 and C18, seasonal factors on Table D10 and combined factors on Table D16 are shown with two decimals in the regular output only. Tables of ratios are shown with one decimal. The allowed values for other tables are the same as in the "number of decimals on input cards" in column 19.

Option Section

Option Code	Card Column	Punch	Description
A	23		**Type of Adjustment**
		Blank	Multiplicative adjustment.
		1	Additive adjustment.
		2	Logarithmic adjustment.
B	24		**Adjustment of Yearly Totals**
		Blank	No adjustment of yearly totals.
		1	Adjust the seasonally adjusted series to make the yearly totals of the seasonally adjusted series and original series the same.
C	25		**Type of Program**
		Blank	Seasonal adjustment.
		1	Summary measures develops estimates of the trend-cycle, irregular, $\overline{I}/\overline{C}$, MCD and residual trading-day and seasonal variation from a seasonally adjusted input.
D	26		**Type of Printout**
		Blank	Standard printout from 19 to 31 tables are printed depending on which other options are selected.
		1	Brief printout. From three to four tables are printed (A1, D10, and D11 and D16).
		2	Analysis printout. From seven to 13 tables are printed (A1, D, E, and F tables).
		3	Short printout. From seven to 13 tables are printed (mainly D and F tables).
		4	Long printout. From 28 to 42 tables are printed.
		5	Full printout. From 45 to 62 tables are printed.
E	27		**Charts**
		Blank	Standard charts. The original series, 12 monthly seasonal charts and the trend-cycle chart are printed.
		1	No charts.
		2	All charts, 12 monthly seasonal charts and charts of the original series, trend-cycle, irregular, seasonal factors and the Kolmogorov-Smirnov cumulative periodogram.
F	28 - 29		**Lower Sigma Limit for Graduating Extreme Values in Estimating Seasonal and Trend-cycle Components**
		Blank	Assign full weight to irregular values within 1.5 σ limits.
		01 - 99	Irregulars will be assigned full weight within the σ limit entered here (where 01 means a σ limit of 0.1).
G	30 - 31		**Upper Sigma Limit for Graduating Extreme Values**
		Blank	Assign zero weight to irregular values outside the 2.5 σ limit.
		01 - 99	Irregulars will be assigned zero weight outside the σ limit entered here (where 01 means a σ limit of 0.1)

Option Section – Continued

Option Code	Card Column	Punch	Description
H	32		**Moving Average for Seasonal Factor Curves**
			For series shorter than five complete years, the program chooses **only** the stable seasonality option and the user has no control over it.
		Blank	Select a 3 x 3 for the first estimate of the seasonals in each interation and a 3 x 5 in the final estimate.
		1	Select a 3 x 3 moving average in all iterations.
		2	Select a 3 x 5 moving average in all iterations.
		3	Select a 3 x 9 moving average in all iterations.
		4	Select a stable seasonal (average of all values for the month) in all iterations.
		5	This option will select a different moving average for each month. The program chooses the appropriate average and the user has no control over the selection procedure. For the selection of different moving averages for different months the user is referred to Section 2 of Part A.
I	33		**Moving Average for Variable Trend-cycle Routine**
		Blank	The program will select an appropriate moving average from the three listed.
		1	Select a 9-term Henderson.
		2	Select a 13-term Henderson.
		3	Select a 23-term Henderson.
J	34		**One Year of Forecasts and Backcasts Using ARIMA Extrapolation Routine**
			This option generates one year of extrapolated values at the beginning (backcasts) and or at the end (forecasts) of the series and it can be applied **only** to series of at least five complete years. For series longer than 15 complete years, only the last 15 years will be used to fit the model. The extrapolated values are printed only in Table B1 and not used for the calculations of the summary measures.
		Blank	No extrapolation.
		1	Three ARIMA models are automatically fitted to the unajusted series. The model giving the smallest average extrapolation error for the last three years is chosen to produce one year of extrapolated values at both ends of the series. None of the models is selected and, therefore, no extrapolation is made if: (1) the absolute average error for the last three years is greater than 12% for the forecasts or 18% for the backcasts; or (2) the χ^2 probability is smaller than 10%; or (3) there are signs of over-differencing. If the above criteria failed marginally, the user can still apply the model that gives the smallest extrapolation error by resubmitting the series with the option where the user provides his own model.
		2	A model chosen by the user will be fitted to the unadjusted series and the extrapolated values will be used even if the model does not pass the above acceptance criteria. A card containing the model identification information **must** immediately follow the "M" card or the X-card if present if this option is selected. The data and format for this card are described in Section 3 of Part A.
		3	Similar to (1) but the extreme values of the original series are automatically replaced by their corresponding function values of the ARIMA model chosen. This option should be used when the unadjusted series is strongly affected by outliers to avoid a bad extrapolation and a poor estimation of the seasonal factors. The replacement of the extreme values is not made for 2(p+Pxs+d+Dxs) observations at the beginning of the series. This means that for a (0,1,1) $(0,1,1)_{12}$ ARIMA monthly model, no replacement of extremes is made for the first 26 months of the series.
		4	Similar to (2) but the extreme values of the original series are automatically replaced by their corresponding function values of the ARIMA model chosen. This option should be used when the unadjusted series is strongly affected by outliers to avoid a bad extrapolation and a poor estimation of the seasonal factors. The replacement of the extreme values is not made for 2(p+Pxs+d+Dxs) observations at the beginning of the series. This means that for a (0,1,1) $(0,1,1)_{12}$ ARIMA monthly model, no replacement of extremes is made for the first 26 months of the series.
		5	Similar to (1) but the ARIMA model is used to generate **only** forecasts.
		6	Similar to (2) but the ARIMA model is used to generate **only** forecasts.
		7	Similar to (3) but the ARIMA model is used to generate **only** forecasts.
		8	Similar to (4) but the ARIMA model is used to generate **only** forecasts.

Option Section – Continued

Option Code	Card Column	Punch	Description	
K	35		**Adjustment of Trend-cycle for Strikes**	
			Modification of extremes values may be made before computing the trend-cycle estimate. This adjustment for extremes substantially reduces the effect of major prolonged strikes or similar irregular occurrences on the B7 and subsequent trend-cycle estimates. Care should be exercised in its use, however, since for some series the estimates near sharp business cycle peaks or troughs will be similarly affected.	
		Blank	Compute the B7 trend-cycle curve without strike adjustment.	
		1	Do strike adjustment before computing the B7 trend-cycle curve.	
L	36		**Prior Monthly Adjustment Factors**	
			This option is used to specify whether or not a prior adjustment is required and in what format the prior factors must be read. The prior factors are divided into the original data, before the multiplicative or logarithmic seasonal adjustment process. They are subtracted from the original series before an additive adjustment.	
		Blank	No prior monthly adjustment.	
		1	Year and identifier on the right, data in 6-digit fields.	**FORTRAN FORMAT** (12F6.0, I2,A6)
		2	User supplied format.	**A FORTRAN FORMAT** card describing the data areas only is required after the main X-11-ARIMA control card. See Section 5.
		3	Year and Identifier on the right of 2nd card (two cards per year) data in 12-digit fields.	**FORTRAN FORMAT** (6F12.0, /, 6F12.0, I2,A6)
		4	**STC Standard Format**	
			Identifier and year on the left (monthly series), data in 6-digit fields.	**FORTRAN FORMAT** (A6,I2,12F6.0)
		5	Tape or disk in CANSIM data base utility format, data in 16-digit fields.	**FORTRAN FORMAT** (A8,I2,10X,12E16.10,18X)
		6	Identifier and year on the left on the first of two cards (two cards per year), data in 12-digit fields.	**FORTRAN FORMAT** (A6,I2,6F12,0,/,8X,6F12.0)
M	37-44	Any	Prior monthly adjustment identification code. This code may be numeric, alphabetic, or mixed and must be identical to the prior series identifier on the data cards. See Section 10 for a description of the prior monthly adjustment factor cards.	
N	45-72		**Prior Daily Weights**	
			(This option is available only with multiplicative or logarithmic adjustment.) Seven daily weights may be entered in these columns to adjust for trading-day variation prior to the seasonal adjustment process. The seven weights are combined to yield the prior trading-day adjustment factors shown in Table A4. Each weight is entered in a 4-digit field with the decimal point assumed to be between the first and second digits. The range of acceptable entries is 0000 to 9999 corresponding to a range in weights of 0.000 to 9.999. The program adjusts the weights to total 7.000. These weights may be modified by the trading-day regression routine.	
	45-48	0000-9999	Prior weight for Monday.	
	49-52	0000-9999	Prior weight for Tuesday.	
	53-56	0000-9999	Prior weight for Wednesday.	
	57-60	0000-9999	Prior weight for Thursday.	
	61-64	0000-9999	Prior weight for Friday.	
	65-68	0000-9999	Prior weight for Saturday.	
	69-72	0000-9999	Prior weight for Sunday.	
O	73	X	**X-card Indicator**	
			An X-card will follow immediately behind the main control card.	
		Blank	No X-card is present in the control deck.	

Option Section – Concluded

Option Code	Card Column	Punch	Description
P	74		**Trading-day Regression**
			Estimates of the seven daily trading-day weights may be made from the data. These estimates may be computed and used, not used or used only if they explain significant variations on the basis of an F test. Prior weights, if supplied, may or may not be corrected by these estimates. See Appendix A.
		Blank	Exclude the computation of the trading-day regression.
		1	Compute the trading-day regression and print the results but do not adjust the series by the factors computed.
P	74	2	Compute the trading-day regression, print the results and adjust the series by the regression estimates. If prior factors have been supplied, correct them on the basis of these estimates.
		3	Compute the trading-day regression and print the results. In iteration B of the program (see Appendix A), adjust the series by the regression estimates or prior factors corrected by the regression estimates to obtain preliminary weights for the irregular series. In iteration C (see Appendix A), use the regression estimates only if they explain significant variation on the basis of the F test.
Q	75 - 76		**Starting Date for Computing Trading-day Regression**
			(This option is meaningful only if the trading-day regression is computed in option P.)
		Blank	Derive estimates of the trading-day weights using the entire series as input to the regression.
		00 - 99	Derive estimates of the trading-day weights using only the part of the series beginning with January of the year punched here as input to the regression.
R	77 - 78		**Starting Date for Applying Trading-day Regression**
			(This option is meaningful only if the trading-day regression is applied in option P.) The starting date determined by this option is independent of the date selected in option Q and may be the same, earlier or later.
		Blank	Apply the trading-day regression estimates or prior trading-day weights corrected by regression estimates to the entire series.
		00 - 99	Apply the trading-day regression estimates only to the part of the series beginning with January of the year punched here. If prior weights are supplied, adjust the part of the series preceding this date by the prior weights only, and adjust the part of the series from this date to the end by the prior weights corrected by the regression estimates.
S	79 - 80		**Sigma Limit for Excluding Extreme Values from Trading-day Regression**
			(This option is meaningful only if the trading-day regression is computed in option P.)
			In estimating trading-day variation from the data, irregular values more than a designated number of standard deviations (σ's) from 1.0 in the multiplicative version (or 0.0 in the additive version) are excluded as extreme. These values are shown in Tables B14 and C14. Usually a limit of 2.5 σ is satisfactory. For more details, see Appendix A.
		Blank	Exclude irregular values beyond a σ limit of 2.5.
		01 - 99	Exclude irregular values beyond a σ limit between 0.1 and 9.9.

PART A.2. Quarterly Seasonal Adjustment Card

Data Description Section (Mandatory)

Card Column	Punch	Description	
1		CONTROL CARD IDENTIFIER	
	Q	Quarterly seasonal adjustment.	
2		INPUT FORMAT CONTROL	
	Blank	Year and identifier on the right, data in 6-digit fields.	**FORTRAN FORMAT** (4(12X,F6.0), I2, A6)
	1	User supplied format.	**A FORTRAN FORMAT** card describing data areas only is required after the main X-11-ARIMA control card. See Section 4.
	2	Year and identifier on the right, data in 12-digit fields.	**FORTRAN FORMAT** (4F12.0, 24X, I2, A6)

Data Description Section (Mandatory) – Concluded

Card Column	Punch	Description	
2	3	**STC Standard Format**	
		Identifier and year on the left, data in 6-digit fields.	**FORTRAN FORMAT** (A6, I2, 4 (12X, F6.0))
	4	Tape or disk in CANSIM data base utility format, data in 16-digit fields.	**FORTRAN FORMAT** (A8, I2, 10X, 12E16.10, 18X)
	5	Identifier and year on the left, data in 12-digit fields.	**FORTRAN FORMAT** (A6,I2,4F12.0)
3 - 10	Any	**Series Identification Code** may be numeric, alphabetic or mixed; must be identical to series identifier on data cards. The series identifier must be **left** justified, i.e., if the data records have a six-column identifier, punch it in columns 3 to 8 inclusive.	
11 - 12	01 - 04	Number of the quarter in which series starts, i.e., 01 for first quarter, 02 for second quarter, 03 for third quarter and 04 for fourth quarter. The first entry on the first data card must be made in the field corresponding to the quarter entered here. Thus if the series begins in the third quarter, the first two data values on the first data card must be blank.	
13 - 14	00 - 99	Last two digits of the year in which the series starts. This date must be the same as the year punched on the first data card for this series. The first two digits of the year, in this field and all others calling for a year entry, are assumed to be 19.	
15 - 16	01 - 04	Number of the quarter in which the series ends	
17 - 18	00 - 99	Last two digits of the year in which the series ends. This date must be the same as the year punched on the last data card for this series.	
19		**Number of Decimals on Input Cards.** This option can be used to modify input formats 0,2,3, and 5 in column 2 on this card. This option will have no effect on input formats 1 and 4.	
	Blank	No decimals.	
	1	1 decimal.	
	2	2 decimals.	
	3	3 decimals.	
	4	4 decimals.	
	5	5 decimals.	
20		**Tape or Disk Input**	
	Blank	Input data on cards.	
	1	Input data on tape or disk.	
	2	Input data on tape or disk and the tape is rewound before reading.	
	3	Input data on tape or disk and concatenated input files can be read.	
21		**Special Output** (Card, Tape, Disk, etc.).	
	Blank	No special output.	
	1	Special output. If this option is selected, a control card describing the special output must follow this card. See Section 6.	
22	0 - 5	Number of decimals on output tables. All tables will be printed with the number of decimals entered here. In the multiplicative version, seasonal factors on Table D10 are shown with two decimals in the regular output only. Tables of ratios are shown with one decimal. The allowed values for other tables are the same as the input decimals option in column 19.	

Option Section

Option Code	Card Column	Punch	Description
A	23		**Type of Adjustment**
		Blank	Multiplicative adjustment.
		1	Additive adjustment.

Option Section – Continued

Option Code	Card Column	Punch	Description
A	23	2	Logarithmic adjustment.
B	24		**Adjustment of Yearly Totals**
		Blank	No adjustment of yearly totals.
		1	Adjust the seasonally adjusted series to make the yearly totals of the seasonally adjusted and original series the same.
C	25		**Type of Program**
		Blank	Seasonal adjustment.
		1	Summary measures develops estimates of the trend-cycle, irregular, $\overline{I}/\overline{C}$, QCD and residual seasonal variation from a seasonally adjusted input.
D	26		**Type of Printout**
		Blank	Standard printout from 19 to 31 tables are printed depending on which other options are selected.
		1	Brief printout. From three to four tables are printed (A1, D10, and D11).
		2	Analysis printout. From seven to 13 tables are printed (A1, D, E and F tables)
		3	Short printout. From seven to 13 tables are printed (mainly D and F tables).
		4	Long printout. From 28 to 42 tables are printed.
		5	Full printout. From 45 to 62 tables are printed.
E	27		**Charts**
		Blank	Standard charts. The original series, four quarterly seasonal charts and the trend-cycle charts are printed.
		1	No charts.
		2	All charts, four quarterly seasonal charts and the charts of the original series, trend-cycle, irregular, seasonal factors and Kolgomorov-Smirnov cumulative periodogram.
F	28-29		**Lower Sigma Limit for Graduating Extreme Values in Estimating Seasonal and Trend-cycle Components**
		Blank	Assign full weight to irregular values within the 1.5 σ limits.
		01-99	Assign full weight to irregular values with a σ limit between 0.1 and 9.9.
G	30-31		**Upper Sigma Limit for Graduating Extreme Values**
		Blank	Assign zero weight to irregular values outside the 2.5 σ limit.
		01-99	Assign zero weight to irregular values outside a σ limit between 0.1 and 9.9.
H	32		**Moving Averages for Seasonal Factor Curves**
			For series shorter than five complete years, the program chooses **only** the stable seasonality option and the user has no control over it.
		Blank	Select a 3 x 3 for the first estimate of the seasonals in each iteration and a 3 x 5 in the final estimate.
		1	Select a 3 x 3 moving average in all iterations.
		2	Select a 3 x 5 moving average in all iterations.
		3	Select a 3 x 9 moving average in all iterations.
		4	Select a stable seasonal (average of all values for the quarter) in all iterations.
		5	This option will select a different moving average for each quarter. The program chooses the appropriate average and the user has no control over the selection procedure. For the selection of different moving averages for different quarters, the user is referred to Section 2 of Part A.
I	33		**Moving Average for Variable Trend-cycle Routine**
		Blank	The program will select an appropriate moving average from the two listed.
		1	Select a 5-term Henderson.
		2	Select a 7-term Henderson.

Option Section – Continued

Option Code	Card Column	Punch	Description	
J	34		**One Year of Forecasts and Backcasts Using ARIMA Extrapolation Routine** This option generates one year of extrapolated values at the beginning (backcasts) and or the end (forecasts) of the series and it can be applied **only** to series of at least five complete years. For series longer than 15 complete years, only the last 15 years will be used to fit the model. The extrapolated values are added to the unadjusted series to improve the seasonal adjustment of the most recent years. The extrapolated values are printed only in Table B1 and not used for the calculations of the summary measures.	
J	34	Blank	No extrapolation.	
		1	Three ARIMA models are automatically fitted to the unajusted series. The model giving the smallest average extrapolation error for the last three years is chosen to produce one year of extrapolated values at both ends of the series. None of the models is selected and, therefore, no extrapolation is made if: (1) the absolute average error for the last three years is greater than 12% for the forecasts or 18% for the backcasts; or (2) the χ^2 probability is smaller than 10%; or (3) there are signs of over-differencing. If the above criteria failed marginally, the user can still apply the model that gives the smallest extrapolation error by resubmitting the series with the option where the user provides his own model.	
		2	A model chosen by the user will be fitted to the unadjusted series and the extrapolated values will be used even if the model does not pass the above acceptance criteria. A card containing the model identification information **must** immediately follow the "Q" card or the X card (if present) if this option is selected. The data and format for this card are described in Section 3 of Part A.	
		3	Similar to (1) but the extreme values of the original series are automatically replaced by their corresponding function values of the ARIMA model chosen. These options should be used when the unadjusted series is strongly affected by outliers to avoid a bad extrapolation and a poor estimation of the seasonal factors. The replacement of the extreme values is not made for the 2(p+Pxs+d+Dxs) observations at the beginning of the series. This means that for a (0,1,1) $(0,1,1)_4$ ARIMA quarterly model, no replacement of extremes is made for the first 10 quarters of the series.	
		4	Similar to (2) but the extreme values of the original series are automatically replaced by their corresponding function values of the ARIMA model chosen. These options should be used when the unadjusted series is strongly affected by outliers to avoid a bad extrapolation and a poor estimation of the seasonal factors. The replacement of the extreme values is not made for the 2(p+Pxs+d+Dxs) observations at the beginning of the series. This means that for a (0,1,1) $(0,1,1)_4$ ARIMA quarterly model, no replacement of extremes is made for the first 10 quarters of the series.	
		5	Similar to (1) but the ARIMA model is used to generate **only** forecasts.	
		6	Similar to (2) but the ARIMA model is used to generate **only** forecasts.	
		7	Similar to (3) but the ARIMA model is used to generate **only** forecasts.	
		8	Similar to (4) but the ARIMA model is used to generate **only** forecasts.	
K	35		**Adjustment of Trend-cycle for Strikes** Modifications of extreme values may be made before computing the trend-cycle estimate. This adjustment for extremes substantially reduces the effect of major prolonged strikes or similar irregular occurrences on the B7 and subsequent trend-cycle estimates. Care should be exercised in its use, however, since for some series the estimates near sharp business cycle peaks or troughs will be similarly affected.	
		Blank	Compute the B7 trend-cycle curve without strike adjustment.	
		1	Perform the strike adjustment before computing the B7 trend-cycle curve.	
L	36		**Prior Quarterly Adjustment Factors** This option is used to specify whether or not a prior adjustment is required and in what format the prior adjusted series must be read. The prior factors are divided into the original data before the multiplicative or logarithmic seasonal adjustment process. They are subtracted from the original series before the additive adjustment.	
		Blank	No prior quarterly adjustment.	
		1	Year and identifier on the right, data in 6-digit fields.	**FORTRAN FORMAT** (4(12X,F6.0), I2, A6)
		2	User supplied format.	**A FORTRAN FORMAT** card describing data areas only is required after the main X-11 control card. See Section 5.
		3	Year and identifier on the right, data in 12-digit fields.	**FORTRAN FORMAT** (4F12.0,24X,I2,A6)

Option Section – Concluded

Option Code	Card Column	Punch	Description	
L	36	4	**STC Standard Format**	
			Identifier and year on the left, data in 6-digit fields.	**FORTRAN FORMAT** (A6, I2, 4 (12X, F6.0))
		5	Tape or disk in CANSIM data base utility format, data in 16-digit fields.	**FORTRAN FORMAT** (A8, I2, 10X, 12E16.10, I8X)
		6	Identifier and year on the left, data in 12-digit fields.	**FORTRAN FORMAT** (A6, I2, 4F12.0)
M	37-44	Any	Prior quarterly adjustment identification code. This code may be numeric, alphabetic, or mixed and must be identical to the prior series identifier on the data cards, see Section 10 of this part for a description of the prior quarterly adjustment factor cards.	
			X-card Indicator	
	73	X	An X-card will follow immediately behind the main control card.	
		Blank	No X-card is present in the control deck.	

Section 2. Extra Options Control Card (Optional)

This optional control card allows the user to: (i) select a centred 24-or 8-term moving average for monthly or quarterly data to replace the centred 12- or 4-term moving average used for a preliminary estimation of the trend-cycle; (ii) include length-of-month variation in trading-day factors; (iii) select different moving averages for different months or quarters and; (iv) perform direct and indirect seasonal adjustment of composite series when each component enters either subtracting, multiplying, dividing or summing with a constant weight different from one. For direct and indirect seasonal adjustment this extra options control card must be used with other control cards as described in Part B of this user's manual.

This extra options control card must always have an "X" punched in column 1 for its identification. If this extra options control card is present, the user must punch an "X" in column 73 of the main control card.

Extra Options Control Card (Optional)

Card Column	Punch	Description
1	X	This is a required entry and identifies this card as the control card for extra options selected by the user.
2	Blank	Monthly – 12-term centred moving average. (Quarterly – 4-term centred moving average.)
	1	Monthly – 24-term centred moving average. (Quarterly – 8-term centred moving average.)
3		**Length-of-month Allowance**
		(This option is meaningful only if a prior and/or trading-day regression is made, and is available only with the multiplicative adjustment.) The option allows the inclusion of variations arising from the length of the month in the seasonal factors or in the trading-day factors.
	Blank	Do not include an allowance for the length of month in the trading-day factors. Length-of-month variations are included with the seasonal factors. Divisors used in the construction of monthly weights are 31, 30, and 28.25 for 31 and 30 day months and February, respectively.
	1	Include length-of-month variation in the trading-day factors rather than in the seasonal factors. Divisors for all months is 30.4375, the average length of a month.
4	Blank	a – No compositing called for or b – series to be only added if compositing.
	1	Series enters into the composite by being subtracted.
	2	Series enters into the composite by being multiplied.
	3	Series enters into the composite by being divided.

Extra Options Control Card (Optional) – Concluded

Card Column	Punch	Description
5-9	Blank	a – No compositing called for or b – component series are not to be multiplied by a constant before doing compositing called for on column 4 of the card.
	00001 - 99999	Component series are to be mutiplied by a constant, .001 to 99.999 before doing compositing called for on column 4 of this card.
10	Blank	The same moving average, specified in column 32 of the main control card, will be used for every month or quarter.
	1	Select a 3 x 3 moving average for January or the first quarter.
	2	Select a 3 x 5 moving average for January of the first quarter.
	3	Select a 3 x 9 moving average for January or the first quarter.
	4	Select a stable seasonal (average of all values for the month) for January or the first quarter.
11	0-4	Same options as column 10 for February or second quarter.
12	0-4	Same options as column 10 for March or the third quarter.
13	0-4	Same options as column 10 for April or the fourth quarter.
14	0-4	Same options as column 10 for May.
15	0-4	Same options as column 10 for June.
16	0-4	Same options as column 10 for July.
17	0-4	Same options as column 10 for August.
18	0-4	Same options as column 10 for September.
19	0-4	Same options as column 10 for October.
20	0-4	Same options as column 10 for November.
21	0-4	Same options as column 10 for December.

Section 3. The ARIMA Control Card for User Supplied Model (Optional)

This control card allows the user to specify an ARIMA model. The specification procedure is general enough to cover most of the possible models. If this control card is required, the user **must** punch a "2" in column 34 (option J) of the main control card. There are three models built into the program and if the user wishes, this card is not required to do an ARIMA forecast. A "1" can be punched in column 34 (option J) in the main control card and the program will specify the model. The computing time for the ARIMA option can be reduced considerably by specifying good initial values for the parameters. Thus users should specify the model and the initial parameter values if available.

ARIMA Model Identification Card (Optional)

Option Code	Card Column	Punch	Description
A	1		**Transformation of the Original Data**
		Blank	No transformation.
		L	Logarithmic transformation.
		P	Power transformation. If this option is specified, columns 9 to 11 must be non-zero.
B	2		**The Number of Regular Autoregressive Parameters (p)**
		0	No regular autoregressive parameters.
		1	1 autoregressive parameter.
		2	2 autoregressive parameters.

ARIMA Model Identification Card (Optional) – Continued

Option Code	Card Column	Punch	Description
B	2	3	3 autoregressive parameters.
		4	4 autoregressive parameters.
C	3		**The Number of Regular Differences (d)**
			This option specified the number of successive differences applied to the original series prior to the ARIMA model fit.
		0	No regular differences.
		1	1 regular difference.
		2	2 regular differences.
		3	3 regular differences.
		4	4 regular differences.
D	4	0 - 4	**The Number of Regular Moving-average Parameters (q)**
			There can be 0 to 4 moving average parameters.
E	5	0 - 4	**The Number of Seasonal Autoregressive Parameters (P)**
			There can be 0 to 4 seasonal autoregressive parameters.
F	6	0 - 4	**The Number of Seasonal Differences (D)**
			This option specifies the number of successive differences of span 12 (or span 4 for quarterly series) applied to the original series prior to the ARIMA model fit. There can be from 0 to 4 seasonal differences.
G	7	0 - 4	**The Number of Seasonal Moving-average Parameters (Q)**
			There can be 0 to 4 seasonal moving average parameters.
H	8		**Deterministic Constant Term**
		Blank	No deterministic parameters.
		1	Constant deterministic moving-average parameter (θ_o).
		2	Constant deterministic autoregressive parameter (ϕ_o).
I	9 - 11		**Power for Transformation**
		Blank	No power transformation. Column 1 must be blank or "L".
		− 99 999	The value of the power used in the transformation is entered in these columns. The range of acceptable entries is − 99 to 999 corresponding to a range in power of − .99 to 9.99. When this option is used, a "P" must be used in column 1. This option cannot be used if the series has negative or zero values.
J	12 - 18		**Additive Constant to be Added to the Series Before Transformation**
		Blank	No constant added.
		Not Blank	This option is relevant only if a "L" or "P" is specified in column 1. The constant is read in Format F7.2. Thus the constant can assume any value in the range − 9999.99 to 99999.99.
K	19 - 20		**The Maximum Number of Iterations**
		Blank	The maximum number of iterations is 30.
		01 - 50	The maximum number of iterations is the same as specified here.
L	21 - 60		**Initial Values for the Parameters**
			This option allows the users to specify initial values for the parameter defined by options in the ARIMA model. The maximum number of parameters permitted is 10. Thus if column 8 is blank, the sum of columns 2, 4, 5 and 7 must not exceed 10. If column 8 is not blank, the sum of columns 2, 4, 5 and 7 must not exceed 9. The number of parameters specified here **must** equal the total number of parameters in the model. The initial values for the regular auto-regressive paramaters come first, followed by the regular moving average parameter seasonal autoregressive parameters seasonal moving average parameters, and the θ_o or ϕ_o parameters (if applicable).
			The default values for these initial parameters is 0.1. The range of acceptable entries is − 999 to 9999 corresponding to a range in parameters of − 9.99 to 99.99.
	21 - 24	− 999 9999	Initial value of the 1st parameter.
	25 - 28	− 999 9999	Initial value of the 2nd parameter.

ARIMA Model Identification Card (Optional) – Concluded

Option Code	Card Column	Punch	Description
L	29-32	–999 9999	Initial value of the 3rd parameter.
	33-36	–999 9999	Initial value of the 4th parameter.
	37-40	–999 9999	Initial value of the 5th parameter.
	41-44	–999 9999	Initial value of the 6th parameter.
	45-48	–999 9999	Initial value of the 7th parameter.
	49-52	–999 9999	Initial value of the 8th parameter.
	53-56	–999 9999	Initial value of the 9th parameter.
	57-60	–999	Initial value of the 10th parameter.
M	61-80		**Orders for the Parameters** The order of the parameters can be specified by this option. The orders of the regular autoregressive parameters come first, followed by the regular moving average parameter, the seasonal autoregressive and seasonal moving average parameters, and a zero for the order of the θ_o or ϕ_o parameter if applicable. If the user wishes to specify orders, an order **must** be specified for each parameter in the model.
M	61-80	Blank	The default values are 1 for the 1st regular autoregressive parameter, 2 for the 2nd parameter, etc.; followed by a 1 for the 1st regular moving average parameter, 2 for the 2nd parameter etc.; followed by a 1X (seasonal period) for the 1st seasonal autoregressive parameter, a 2X (seasonal period) for the 2nd seasonal autoregressive parameter, etc.; followed by a 1X (seasonal period) for the 1st seasonal moving average parameter, a 2X (seasonal period) for the 2nd seasonal moving average parameter, etc.; and followed by a zero for the θ_o or ϕ_o parameter.
	61-62	01-99	The order for the 1st parameter.
	63-64	01-99	The order for the 2nd parameter.
	65-66	01-99	The order for the 3rd parameter.
	67-68	01-99	The order for the 4th parameter.
	69-70	01-99	The order for the 5th parameter.
	71-72	01-99	The order for the 6th parameter.
	73-74	01-99	The order for the 7th parameter.
	75-76	01-99	The order for the 8th parameter.
	77-78	01-99	The order for the 9th parameter.
	79-80	01-99	The order for the 10th parameter.

Section 4. User Supplied Format Card for the Unadjusted Series (Optional)

The word "format" refers to how the input data are arranged on the cards or records. The format of a data card is a sequence of fields (data points), each of which occupies one or more columns. For the computer program, the format is a set of specifications according to which information is read into the program from punched cards. The specifications tell the program which parts (or columns) of the card to skip, which parts to regard as all one number, and which parts to regard as several numbers in a row. It does this by giving the program a sequence of instructions which indicate the size of a field and the method of handling the field (i.e., skipping it, entering it into the computer as a whole number, entering it into the computer as a number with two decimal digits, etc.).

The X-11-ARIMA program has five built-in formats to input and output data. The user should use these formats whenever feasible because they enable the program to check the identifiers and years for all the input or output data. This feature considerably reduces errors due to misplaced or wrong cards and also allows the user to begin processing of the series in a year other than the first year of the series.

Sometimes the user will find it inconvenient or impossible to have the data prepared in one of the five standard formats. If this is the case, the user **must** punch a "1" in column 2 of the main control card and supply a fortran format statement to the program.

This fortran format statement must be on one, 80 column data card. The format must begin with an open

bracket and end with a closed bracket. Only F-type and E-type formats are permitted on this card. For more information on fortran format statements, the user can read any introductory fortran book.

If a format card is supplied by the user, the identifiers and years cannot be checked by the program. If the input cards have identifiers and years on them, the program must be instructed to skip the columns containing this information.

Section 5. User Supplied Format Card for the Prior Adjustment Factors (Optional)

The format for the prior adjusted monthly or quarterly series need not be the same as the input original series. As in Section 4, there are five standard formats available and the users should use these whenever possible. If the standard formats are used, the identifier given in columns 37 to 44 of the main control card is checked against the identifier used on the prior adjustment data cards.

If the user wishes to apply the format for the prior adjusted series, a "2" should be punched in column 36 (option L) of the main control card. If this option is selected, the identifier in option "M" of the main control card is not checked but the identifier will be printed at the top of Table A2.

Section 6. The Special Output Control Cards (Optional)

Most tables in X-11-ARIMA can be output on cards, tape, or disk. At most nine tables can be reproduced by this option and only those appearing on the main table printout can be reproduced. Thus users should check column 26 of the main control card to see if the table they selected appears in the printout they chose. The user should also check to see if a "1" is punched in column 21 of the main control card because this option must be selected if card output is required. The tables are produced without any headings or titles and in the same sequence as they appear in the printout.

If a "4" is punched in column 2 of this card, the tables cannot be output on cards. The tables must be output on disk or tape because the record length is 230. If a "0", "2", "3" or "5" is punched in column 2, the last two columns of each "output series identification code" must be left blank.

Card, Tape, or Disk Output Option Card (Optional)

Card Column	Punch	Description
1	1-9	**Number of Tables Punched**
2	0-5	**Punch Output Format** The format specification is identical to the "Input Format Control" specification in the main control card of Part A1. If a "1" is entered in this column, the user must supply a format card. The format-card must immediately follow the output option card. If a user's supplied format is used, no identifiers or years will be punched out with the data. Note the output formats need not be the same as the input format.
3-6	B01, D11, D11A, etc.	**The Table Number** of the first table to be punched. The table numbers correspond to those on the printout. Only tables which are printed can be punched. Table number must be left justified. The user should check the printout option and ensure the printout includes all tables to be punched.
7-14	Any	**Output Series Identification Code** to be punched on the output cards for the first table. (No identifier will be punched if a user's supplied format is requested.)
15	0-5	**Number of Decimals** to be punched for Table 1. This option can be used to modify output formats 0, 2, 3 and 5 in column 2 on this card. This option has no effect on output formats 1 and 4.
16-28		**The Second Table** to be punched, i.e., table number, identifier, and the number of decimals (as in columns 3 to 15).
29-41		The third table to be punched.
42-54		The fourth table to be punched.
55-67		The fifth table to be punched.
68-80		The sixth table to be punched. If more than six tables are requested, the output option card must be continued on a second card.
		The Second Output Control Card
1-13		The seventh table to be punched.
14-26		The eighth table to be punched.
27-39		The ninth table to be punched.

Section 7. User Supplied Format Card for the Special Output (Optional)

The output format for special output need not be the same as the input or prior series format. Users can choose one of five standard formats or supply one of their own. If a standard format is chosen, an identifier and the year will be printed on each card. Since this will greatly decrease the chance of misplacing or losing a card, the user should try to choose a standard format whenever possible.

If a non-standard format is required, a "1" should be placed in column 2 of the special output control card and a Fortran format statement must be inserted describing the form of the output. If this option is chosen, identifiers and years cannot be placed on the card output and the number of decimals option becomes inoperative.

Section 8. The Title Card(s) (Mandatory)

This card is identified by a "T" punched in column 1. The name of the series and any other information required by the user is entered on this card. This information will appear at the top of each page of output. Columns 2 to 80 can be left blank with no effect on the program. This card is mandatory for each series being processed.

Title Card(s) (Mandatory)

Card Column	Punch	Description
1	T	This is a required entry and identifies this card as a title card.
2		**The Number of Additional Title Cards**
	Blank	No additional title cards.
	1 - 9	The total number of title cards. There cannot be more than nine title cards.
3 - 80	Any	Series title. Any identification desired may be used.
		Additional Title Cards (Optional)
1 - 80	Any	Additional title information, printed only on the title page of the printout. Total number of title cards is indicated in column 2 of the main title card.

Section 9. The Unadjusted Data Card (Mandatory)

The data cards are placed immediately after the title card. Each series must contain at least three years and no more than 30 years of data if the ARIMA option is not used. If the ARIMA option is used, the series must have at least five years and no more than 29 years of data (series longer than 15 years have no backcasts).

All data points in a series that is to be multiplicatively or logarithmically adjusted must contain a positive, non-zero numeric entry. If a zero or negative value appears in a series for which multiplicative or logarithmic adjustment was requested, the program will automatically switch to an additive method of adjustment. However, if the prior adjustment option is selected, the switch will not be made, since multiplicative prior adjustment factors are not compatible with an additive adjustment.

The data cards must be in calendar order and must agree with the description of the data in columns 1 to 22 of the main control card. Thus the series must be in the format specified in column 2, must begin and end on the dates given in columns 11 to 18, and if a standard format is selected, the series identification on each data card must be identical to that given in column 3 to 10.

If formats 0, 2, 3 or 5 are selected in column 2 of the main control eard, the user must leave columns 9 and 10 in the identification code blank and the columns 3 to 8 must agree exactly with the identification codes on each data card.

The series may begin and end in any month (or quarter) of the year. The series may not start earlier than 1900 nor end later than 1999. If a series starts in a month (or quarter) other than the first, blank fields must appear on the data cards for the missing months (or quarters). These fields are ignored by the program but must be inserted. If a user-supplied format is used, this is no longer true since the user has complete control over the specification of which columns to skip or read.

Leading zeros in the data need not appear, nor the decimal points, because their position can be controlled by the "number of decimals" option in column 19 of the main control card. If no decimals are specified in column 19 but decimals appear in the input data, the number of decimals option is automatically overridden and the number of decimals on the card is read. The number of decimals on the printout (column 22 of the main control card) need not be the same as the number of decimals for the input data.

The input data need not be on cards immediately following the title cards. The data can be placed on a tape or disk completely separated from the other nine

types of input cards. To select this option a "1", "2", or "3" must be punched in column 20 of the main control card.

If this option is selected in conjunction with a standard format option (in column 2 of the main control card), an automated search mechanism is activated in the program. If a "1" is punched, the program will sequentially search through the disk or tape for data with the right identifier and starting year. If a "2" is punched, the disk or tape is rewound before searching for the series. If a "3" is punched, an end-of-file on unit 13 causes the program to increment the Fortran sequence number (i.e., FT13F001 is changed to FT13F002). The "3" punch is used for concatenated files.

Section 10. The Prior Adjustment Data Cards (Optional)

These cards are placed immediately after the data cards. The factors must begin and end in the same months (or quarters) as the input data cards. The prior adjustment cards must be in calendar order and, as in the input data cards, if the series does not begin in the first month (or quarter) the unused fields at the beginning of the first card must be left blank.

The format of the prior adjustment need not be the same as the format for the input data. If a standard format is selected, the series identification code on each prior adjustment card must be identical to the identifier in columns 37 to 44 (option M) of the main control card. If a 1, 3, 4 or 6 is punched in column 36 (option L) of the main control card, columns 43 and 44 must be left blank and columns 37 to 42 must agree exactly with the identification codes on each prior adjustment card.

If an additive adjustment is requested, the number of decimals on each prior adjustment card is assumed to be equal to the number of decimals requested for the input data in column 19 of the main control card. If the adjustment is additive, the prior adjustment series is subtracted from the original series.

If a multiplicative or logarithmic adjustment is requested, the number of decimals on each prior adjustment is assumed to be 3 (unless a user's supplied format is selected, then the user chooses the number of decimals). The prior factors must vary about 100 and no values can be negative (for the user's convenience, a blank value is assumed to be a value of 100). If the adjustment is multiplicative or logarithmic, the factors are divided into the original series.

Section 11. The End of Run Card (Mandatory)

Following the last data card of the last series to be run (or the last prior adjustment card if present) there should be a card with a "Z" punched in column 1 and the other 79 columns left blank. This card signifies to the program that the run is completed. Only one end card should be present regardless of the number of series being processed.

Part B. The Control Cards for the Seasonal Adjustment of Composite Series

The X-11-ARIMA seasonal adjustment program allows the user to seasonally adjust directly and indirectly composite series that result from the addition, subtraction, multiplication or division of any number of components, with equal or different constant weights.

When one of the component series of the composite enters either subtracting, multiplying, dividing or adding but with a weight different from one, then the Extra Options Control Card (the "X" card) must be used. The entries on this card are explained in Part A, Section 2.

For direct seasonal adjustment, the program first composes the unadjusted components and then seasonally adjusts the total. For indirect seasonal adjustment, the program first seasonally adjusts each of the components and then produces the seasonally adjusted composite series by implication. The final output of this program produces two statistics that measure the degree of roughness or lack of smoothing of the direct versus the indirect seasonally adjusted composed.

The indirect seasonal adjustment can be made even when some of the components enter in the unadjusted form. In such cases, a summary measures run must be requested for those components that will not be seasonally adjusted. The user should punch a "1" in column "25" of the main control card of the particular component. To operate the composite series seasonal adjustment program, two control cards with a "C" punched in column "1" are required. The first "C" card comes before the control cards of the series to be composed. This card must have a "C" in column 1 and the remaining 79 columns must be blank. This card initializes a composite run and tells the program that all the series after this control card and before the next "C" card are to be included in the composite.

After the first "C" card follow the control cards for seasonally adjusting each of the components in the composite. All components to be seasonally adjusted must begin in the same month and year, and end in the same month and year. All the components in the aggregate must be monthly or all must be quarterly. There can be no mixing of monthly and quarterly components. There are no restrictions on the other options. Thus the user could do some of the components additively and some multiplicatively. Components can be run with or without ARIMA.

The control cards for the individual components must conform to the specifications and order of Part A of this manual. Note that the main control card and title card

must appear for each component, and other control cards may be required depending on the options selected on the main control cards for the components.

After the data cards for the components, another card with a "C" in column 1 must appear. This card tells the program that the aggregate run is complete. Reading of this card will produce a direct and indirect seasonal adjustment of the composite of the preceding components. This control card must have a "C" in column 1 and column 2 must be blank. Columns 3 to 80 will contain information for the seasonal adjustment of the composite series. The information in these columns is the same as in the main monthly or quarterly control card of Part A – note that columns 3 to 18 are mandatory and failure to fill in these columns will cause the run to abort. Also the user may specify any options desired in columns 21 to 80.

After the second "C" control card, a title card is required and any other control card required by the selection of options in columns 21, 34 and 36 of the second "C" card. The order of these cards must conform to the order given in Part A. In a similar manner, several composite runs can be processed together or after a composite run series can be seasonally adjusted individually.

Part C. File Description For the X-11-ARIMA Program

There are five output files and one or two input files depending on how the user prepares his input program control cards and data. All these files are assigned to different logical units, described below:

1. Unit 3 is for the print output file on the printer. It is a log of computer run and error messages. If you do not require this printout, change this card to a dummy card, e.g. (for IBM 360/370 OS) //FT03F001 DD DUMMY
2. Unit 9 is for the output file which contains the main printout of the X-11-ARIMA tables and charts.
3. Unit 11 is for the output file which contains the special table output from the program. This unit can be assigned to a card punch, disk, tape or any other output device to suit your request. This card is optional. It can be absent or dummied if no special output is requested.
4. Unit 15 is for the output file which has summary quality control statistics for all of the series run.
5. Unit 16 is for the output file which contains copies of the F2 and F3 tables for the series run. It also can be a dummy card.
6. Unit 1 is for the input file. This input unit is usually assigned to a card reader, but can be assigned to any other input device. The program control cards and data may be in one stream to this unit or separated into two different units. In the latter case, the program control cards will go into unit 1 and the data will be assigned to unit 13. In this case, an additional JCL card, e.g. (for the IBM 360/370 OS)

   //FT13F001 DD DSN=DATA.SET.NAME,UNIT=. . .

   should be added.

A corresponding JCL example to run this job for IBM 360/370 OS is given below.

Suppose that the user has catalogued the load module in a library named USER.LIB (X11ARIMA) then the JCL to run this program is:

a) // job card

b) // EXEC PGM=X11ARIMA, REGION=260K

c) // STEPLIB DD DSN=USER.LIB,DISP=SHR

1) //FT03F001 DD SYSOUT=A,DCB=RECFM=UA

2) //FT09F001 DD SYSOUT=A,DCB=RECFM=UA

3) //FT11F001 DD SYSOUT=B,DCB=(RECFM=F,
// BLKSIZE=80)

4) //FT15F001 DD SYSOUT=A,DCB=RECFM=UA

5) //FT16F001 DD SYSOUT=A,DCB=RECFM=UA

6) //FT01F001 DD *

control cards and data

d) // job end card

In this example 1) to 6) are the corresponding JCL cards for the files described previously. Lines a), b), c) and d) will depend on the computer system.

Part D. Sample Printouts

For illustration purposes, sample printouts of seasonal adjustment of single series and of composite series have been incorporated into this manual. The single series processed by X-11-ARIMA are: (i) "Finance, Checks Cashed in Canadian Clearing Centres", and (ii) "Freight and Shipping Payments". The first series is monthly and a **full printout** of the selected options is shown. The second series is quarterly and an **analysis printout** of the selected options is shown.

The composite series directly and indirectly seasonally adjusted is "Unemployed Both Sexes, 16 to 19" that results from the addition of "Unemployed Males 16 to 19" and "Unemployed Females 16 to 19". **Brief printouts** are shown for the direct and the indirect seasonally adjusted totals.

Finance, Checks Cashed in Clearing
Centres,
by Acc. Personal Checks –
Monthly Full Printout

STATISTICS CANADA

X-11 ARIMA MONTHLY SEASONAL ADJUSTMENT METHOD

THIS METHOD MODIFIES THE X-11 VARIANT OF CENSUS METHOD II
BY J. SHISKIN, A.H. YOUNG AND J.C. MUSGRAVE OF FEBRUARY, 1967.
THE MODIFICATIONS MADE ARE BASED ON THE METHODOLOGICAL RESEARCH
DEVELOPED BY ESTELA BEE DAGUM, CHIEF OF THE SEASONAL ADJUSTMENT
AND TIME SERIES STAFF OF STATISTICS CANADA. SEPTEMBER, 1979.

SERIES TITLE- FINANCE,CHECKS CASHED IN CLEARING CENTERS-BY ACC.PERSONAL CHECKS SERIES NO. FINALM

-PERIOD COVERED- 1ST MONTH,1968 TO 12TH MONTH,1977
-TYPE OF RUN - MULTIPLICATIVE SEASONAL ADJUSTMENT
- FULL PRINTOUT. ALL CHARTS.
-SIGMA LIMITS FOR GRADUATING EXTREME VALUES ARE 1.5 AND 2.5 .
-ONE YEAR OF FORECASTS AND BACKCASTS FROM ARIMA MODEL SELECTED BY THE PROGRAM.
-PRIOR TRADING DAY ADJUSTMENT WITHOUT LENGTHOF , MONTH ADJUSTMENT.
-TRADING DAY REGRESSION COMPUTED STARTING 1968 EXCLUDING IRREGULAR VALUES OUTSIDE 2.5-SIGMA LIMITS.
-TRADING DAY REGRESSION ESTIMATES APPLIED STARTING 1968 IF SIGNIFICANT.

```
                                          1         2         3         4         5         6         7         8
COLUMN NUMBER                   : 12345678901234567890123456789012345678901234567890123456789012345678901234567890

IMAGE OF THE MAIN OPTION CARD: M3FINALM  01681277       52      1          1272107116741090092904310532 3
```

A 1. ORIGINAL SERIES

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
1968	456.	447.	477.	530.	619.	555.	607.	576.	630.	666.	744.	782.	7089.
1969	697.	734.	734.	789.	901.	884.	854.	777.	838.	881.	911.	928.	9928.
1970	881.	792.	871.	911.	961.	972.	1016.	923.	1043.	1005.	1092.	1088.	11555.
1971	962.	968.	1115.	1044.	1137.	1195.	1164.	1108.	1180.	1136.	1301.	1290.	13600.
1972	1279.	1287.	1430.	1437.	1654.	1626.	1562.	1674.	1572.	1763.	2187.	1625.	19096.
1973	1735.	1576.	1753.	1767.	2223.	2189.	2072.	2116.	1980.	2238.	2259.	2090.	23998.
1974	2204.	2107.	2285.	2714.	3029.	2691.	2746.	2626.	2645.	2720.	2927.	2771.	31465.
1975	2695.	2597.	2592.	2931.	2931.	3120.	3108.	2894.	3162.	3160.	3017.	3288.	35495.
1976	3077.	3100.	3360.	3262.	3559.	3777.	3574.	3499.	3782.	3720.	3891.	3671.	42272.
1977	3315.	3414.	3797.	3449.	4253.	4342.	3909.	3991.	4144.	3809.	4444.	4128.	46995.
AVGE	1730.	1702.	1841.	1883.	2127.	2135.	2061.	2018.	2098.	2110.	2277.	2166.	

TABLE TOTAL- 241493. MEAN- 2012. STD. DEVIATION- 1145.

FINANCE,CHECKS CASHED IN CLEARING CENTERS-BY ACC.PERSONAL CHECKS

A 4. PRIOR TRADING DAY ADJUSTMENT FACTORS

A4A. PRIOR DAILY WEIGHTS -

MON	TUE	WED	THUR	FRI	SAT	SUN
1.272	1.071	1.674	1.090	0.929	0.431	0.532

A4B. PRIOR TRADING DAY FACTORS WITHOUT LENGTH OF MONTH ADJUSTMENT

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	AVGE
1968	103.3	103.0	96.4	101.1	102.2	96.5	103.3	98.2	99.3	102.7	97.9	99.6	100.3
1969	102.2	99.1	97.5	102.5	98.2	99.3	102.7	96.4	101.1	102.2	96.5	103.3	100.1
1970	98.2	99.1	99.6	102.5	96.4	101.1	102.2	97.5	102.5	98.2	99.3	102.7	100.0
1971	96.4	99.1	103.3	100.1	97.5	102.5	98.2	99.6	102.5	96.4	101.1	102.2	99.9
1972	97.5	102.9	102.2	96.5	103.3	100.1	97.5	102.7	97.9	99.6	102.5	96.4	99.9
1973	103.3	99.1	98.2	99.3	102.7	97.9	99.6	102.2	96.5	103.3	100.1	97.5	100.0
1974	102.7	99.1	96.4	101.1	102.2	96.5	103.3	98.2	99.3	102.7	97.9	99.6	99.9
1975	102.2	99.1	97.5	102.5	98.2	99.3	102.7	96.4	101.1	102.2	96.5	103.3	100.1
1976	98.2	101.0	103.3	100.1	97.5	102.5	98.2	99.6	102.5	96.4	101.1	102.2	100.2
1977	97.5	99.1	102.7	97.9	99.6	102.5	96.4	103.3	100.1	97.5	102.5	98.2	99.8
AVGE	100.2	100.1	99.7	100.4	99.8	99.8	100.4	99.4	100.3	100.1	99.6	100.5	

TABLE TOTAL- 12003.2 MEAN- 100.0 STD. DEVIATION- 2.4

A4C. PRIOR TRADING DAY ADJUSTMENT FACTORS, ONE YEAR AHEAD

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	AVGE
1978	99.6	99.1	102.2	96.5	103.3	100.1	97.5	102.7	97.9	99.6	102.5	96.4	99.8

AUTOREGRESSIVE INTEGRATED MOVING AVERAGE (ARIMA) EXTRAPOLATION PROGRAM

A5. ARIMA EXTRAPOLATION MODEL (FORECAST)

THIS PROGRAM WAS DEVELOPED FOLLOWING THE PROCEDURES OUTLINED IN 'TIME SERIES ANALYSIS' BY G. E. P. BOX AND G. M. JENKINS.

MODEL	TRAN.	ADDITIVE CONSTANT	AVERAGE PERCENTAGE STANDARD ERROR IN FORECASTS: LAST 3 YEARS	LAST YEAR	LAST-1 YEAR	LAST-2 YEAR	CHI-SQ. PROB.	R-SQUARED VALUE	ESTIMATED PARAMETERS
(0,1,1)(0,1,1)	LOG	0.0	6.32	5.02	2.92	11.02	76.06%	0.9904	0.3798E 00 0.6368E 00
(0,2,2)(0,1,1)	LOG	0.0	5.50	5.02	2.51	8.98	78.86%	0.9860	0.1106E 01-0.3112E 00 0.5765E 00

THE MODEL CHOSEN IS (0,2,2)(0,1,1)0 WITH TRANSFORMATION - LOG

AUTOREGRESSIVE INTEGRATED MOVING AVERAGE (ARIMA) EXTRAPOLATION PROGRAM

A6. ARIMA EXTRAPOLATION MODEL (BACKCAST)

THIS PROGRAM WAS DEVELOPED FOLLOWING THE PROCEDURES OUTLINED IN 'TIME SERIES ANALYSIS' BY G. E. P. BOX AND G. M. JENKINS.

MODEL	TRAN.	ADDITIVE CONSTANT	AVERAGE PERCENTAGE STANDARD ERROR IN BACKCASTS: LAST 3 YEARS	LAST YEAR	LAST-1 YEAR	LAST-2 YEAR	CHI-SQ. PROB.	R-SQUARED VALUE	ESTIMATED PARAMETERS
(0,2,2)(0,1,1)	LOG	0.0	9.00	13.66	8.77	4.57	55.98%	0.9910	0.1273E 01-0.3933E 00 0.6792E 00

THE MODEL CHOSEN IS (0,2,2)(0,1,1)0 WITH TRANSFORMATION - LOG

FINANCE,CHECKS CASHED IN CLEARING CENTERS-BY ACC.PERSONAL CHECKS

B 1. PRIOR ADJUSTED ORIGINAL SERIES

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
1967	255.	257.	287.	302.	355.	353.	357.	357.	382.	401.	458.	454.	4220.
1968	442.	434.	495.	524.	605.	575.	588.	586.	634.	649.	760.	785.	7077.
1969	682.	741.	753.	770.	917.	890.	832.	806.	829.	862.	944.	899.	9922.
1970	897.	799.	875.	888.	997.	961.	994.	946.	1018.	1023.	1099.	1059.	11556.
1971	998.	977.	1080.	1043.	1166.	1166.	1185.	1112.	1151.	1178.	1286.	1262.	13603.
1972	1311.	1251.	1399.	1488.	1601.	1625.	1602.	1630.	1606.	1770.	2133.	1685.	19101.
1973	1680.	1590.	1785.	1779.	2165.	2237.	2080.	2070.	2051.	2167.	2258.	2143.	24003.
1974	2146.	2126.	2370.	2683.	2963.	2787.	2659.	2673.	2662.	2649.	2991.	2782.	31491.
1975	2636.	2620.	2658.	2860.	2984.	3140.	3026.	3001.	3126.	3091.	3125.	3184.	35451.
1976	3133.	3069.	3253.	3260.	3649.	3685.	3639.	3513.	3688.	3858.	3847.	3591.	42185.
1977	3399.	3444.	3697.	3524.	4270.	4234.	4054.	3864.	4141.	3905.	4336.	4203.	47073.
AVGE	1598.	1573.	1695.	1738.	1970.	1969.	1910.	1869.	1935.	1959.	2112.	2004.	

TABLE TOTAL- 245681. MEAN- 1861. STD. DEVIATION- 1190.

PRIOR-ADJUSTED ORIGINAL SERIES EXTRAPOLATED ONE YEAR AHEAD

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
1978	4020.	4021.	4324.	4360.	5038.	5079.	4938.	4816.	5080.	5059.	5434.	5236.	57405.

TEST FOR THE PRESENCE OF SEASONALITY ASSUMING STABILITY

	SUM OF SQUARES	DGRS.OF FREEDOM	MEAN SQUARE	F-VALUE
BETWEEN MONTHS	2679.5961	11	243.59964	15.253**
RESIDUAL	1533.1851	96	15.97068	
TOTAL	4212.7812	107		

**SEASONALITY PRESENT AT THE 0.1 PER CENT LEVEL

B 2. TREND CYCLE- CENTERED 12-TERM MOVING AVERAGE

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
1968	467.	486.	506.	527.	550.	576.	600.	623.	646.	667.	690.	716.	7052.
1969	740.	759.	776.	793.	810.	822.	836.	847.	855.	865.	873.	879.	9854.
1970	889.	902.	915.	930.	943.	956.	967.	979.	995.	1010.	1023.	1039.	11548.
1971	1055.	1070.	1083.	1095.	1109.	1125.	1147.	1171.	1196.	1228.	1264.	1302.	13845.
1972	1338.	1377.	1418.	1461.	1521.	1574.	1607.	1637.	1667.	1695.	1731.	1780.	18805.
1973	1825.	1863.	1900.	1935.	1957.	1981.	2020.	2061.	2108.	2170.	2241.	2297.	24359.
1974	2344.	2394.	2444.	2490.	2540.	2598.	2645.	2686.	2718.	2738.	2746.	2761.	31104.
1975	2792.	2820.	2853.	2891.	2915.	2938.	2975.	3014.	3058.	3099.	3144.	3194.	35694.
1976	3242.	3289.	3334.	3389.	3451.	3498.	3526.	3553.	3587.	3617.	3654.	3702.	41845.
1977	3743.	3775.	3808.	3829.	3851.	3897.	3949.	3999.	4049.	4110.	4176.	4244.	47428.
AVGE	1843.	1873.	1904.	1934.	1965.	1997.	2027.	2057.	2088.	2120.	2154.	2191.	

TABLE TOTAL- 241534. MEAN- 2013. STD. DEVIATION- 1132.

B 3. UNMODIFIED SI RATIOS

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	AVGE
1968	94.6	89.4	97.8	99.5	110.2	99.8	98.0	94.2	98.2	97.2	110.1	109.6	99.9
1969	92.2	97.6	97.0	97.1	113.3	108.2	99.5	95.1	96.9	99.7	108.1	102.2	100.6
1970	100.9	88.6	95.5	95.5	105.7	100.5	102.7	96.7	102.3	101.3	107.4	102.0	99.9
1971	94.5	91.3	99.7	95.3	105.1	103.6	103.3	95.0	96.2	96.0	101.7	96.9	98.2
1972	98.0	90.8	98.7	101.9	105.3	103.2	99.6	99.6	96.4	104.4	123.2	94.7	101.3
1973	92.0	85.3	93.9	91.9	110.6	112.9	103.0	100.4	97.3	99.8	100.7	93.3	98.4
1974	91.5	88.8	96.9	107.8	116.6	107.3	100.5	99.5	97.9	96.7	108.9	100.8	101.1
1975	94.4	92.9	93.1	98.9	102.4	106.9	101.7	99.6	102.2	99.7	99.4	99.7	99.2
1976	96.6	93.3	97.6	96.2	105.7	105.3	103.2	98.9	102.8	106.7	105.3	97.0	100.7
1977	90.8	91.3	97.1	92.0	110.9	108.6	102.7	96.6	102.3	95.0	103.8	99.0	99.2
AVGE	94.6	90.9	96.7	97.6	108.6	105.7	101.4	97.6	99.3	99.7	106.9	99.5	

TABLE TOTAL- 11983.6 MEAN- 99.9 STD. DEVIATION- 6.1

FINANCE,CHECKS CASHED IN CLEARING CENTERS-BY ACC.PERSONAL CHECKS

B 4. REPLACEMENT VALUES FOR EXTREME SI RATIOS

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	S.D.
1968	**********	********	********	********	********	********	********	********	********	********	********	101.7	2.4
1969	**********	90.2	********	********	********	102.6	********	********	********	********	********	********	2.4
1970	95.8	********	********	********	********	********	********	********	********	********	********	********	2.4
1971	**********	********	********	********	********	********	********	********	********	100.4	105.9	********	2.4
1972	**********	********	********	********	********	********	********	********	********	********	106.0	********	2.7
1973	**********	********	********	98.0	********	106.7	********	********	********	********	105.6	********	2.9
1974	**********	********	********	98.1	108.5	********	********	********	********	********	********	********	2.9
1975	**********	********	********	********	107.4	********	********	********	********	********	********	********	2.8
1976	**********	********	********	********	********	********	********	********	********	100.7	********	********	2.8
1977	**********	********	********	********	********	********	********	********	********	99.8	********	********	2.7

B 5. SEASONAL FACTORS
3X3 MOVING AVERAGE SELECTED.

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	AVGE
1968	94.6	90.3	97.8	98.5	111.4	101.8	100.0	95.7	98.9	99.3	109.4	102.6	100.0
1969	94.7	90.3	97.8	97.7	110.3	102.1	101.0	95.9	99.0	100.0	108.8	102.1	100.0
1970	95.5	90.4	97.9	97.5	108.2	102.5	101.9	96.6	99.2	101.2	108.0	100.7	100.0
1971	95.5	90.2	98.0	97.7	107.3	103.7	102.6	97.7	98.5	102.1	107.2	98.3	99.9
1972	95.5	89.7	97.8	98.9	107.4	104.8	102.4	99.2	98.2	102.2	107.2	97.0	100.0
1973	94.4	89.3	96.7	99.2	108.7	106.5	102.3	100.0	98.3	100.9	106.5	97.0	100.0
1974	94.1	90.2	96.2	98.9	108.7	107.0	102.0	100.1	99.4	99.8	105.8	98.2	100.0
1975	94.0	91.4	95.8	97.5	108.4	107.2	102.3	99.4	101.0	99.5	104.3	98.8	100.0
1976	94.1	92.3	96.5	96.2	108.0	107.0	102.6	98.8	102.2	100.0	104.0	98.8	100.0
1977	93.5	92.2	96.9	95.0	108.6	107.4	102.9	98.3	102.7	100.4	103.9	98.5	100.0
AVGE	94.6	90.6	97.1	97.7	108.7	105.0	102.0	98.1	99.8	100.5	106.5	99.2	

TABLE TOTAL- 11999.1 MEAN- 100.0 STD. DEVIATION- 5.0

B 6. SEASONALLY ADJUSTED SERIES

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
1968	467.	481.	506.	532.	543.	565.	588.	613.	641.	653.	695.	765.	7048.
1969	720.	820.	770.	788.	832.	871.	824.	841.	837.	862.	868.	880.	9910.
1970	940.	884.	893.	912.	921.	938.	975.	980.	1026.	1011.	1018.	1053.	11549.
1971	1044.	1083.	1101.	1068.	1087.	1125.	1155.	1139.	1168.	1154.	1200.	1283.	13606.
1972	1373.	1394.	1430.	1505.	1491.	1550.	1565.	1644.	1636.	1733.	1990.	1737.	19048.
1973	1780.	1780.	1845.	1793.	1992.	2101.	2034.	2070.	2087.	2148.	2121.	2210.	23960.
1974	2280.	2357.	2464.	2712.	2727.	2606.	2607.	2672.	2677.	2654.	2827.	2834.	31416.
1975	2805.	2866.	2773.	2933.	2753.	2930.	2957.	3019.	3094.	3107.	2997.	3223.	35456.
1976	3328.	3325.	3370.	3389.	3378.	3444.	3548.	3557.	3609.	3858.	3697.	3633.	42137.
1977	3635.	3735.	3817.	3711.	3930.	3943.	3940.	3930.	4032.	3890.	4175.	4265.	47006.
AVGE	1837.	1872.	1897.	1934.	1965.	2007.	2019.	2046.	2081.	2107.	2159.	2188.	

TABLE TOTAL- 241135. MEAN- 2009. STD. DEVIATION- 1131.

FINANCE,CHECKS CASHED IN CLEARING CENTERS-BY ACC.PERSONAL CHECKS

B 7. TREND CYCLE - HENDERSON CURVE
13-TERM MOVING AVERAGE SELECTED. I/C RATIO IS 1.16

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
1968	463.	484.	505.	526.	546.	566.	588.	612.	639.	670.	701.	729.	7028.
1969	754.	776.	795.	811.	823.	833.	839.	844.	851.	860.	873.	885.	9944.
1970	895.	900.	905.	912.	926.	944.	966.	986.	1003.	1018.	1032.	1045.	11532.
1971	1057.	1068.	1080.	1092.	1104.	1116.	1127.	1140.	1159.	1187.	1228.	1280.	13638.
1972	1338.	1393.	1440.	1479.	1507.	1540.	1585.	1642.	1701.	1754.	1788.	1801.	18966.
1973	1803.	1811.	1838.	1886.	1949.	2009.	2052.	2081.	2101.	2119.	2151.	2212.	24011.
1974	2300.	2403.	2505.	2588.	2640.	2659.	2662.	2665.	2684.	2720.	2765.	2801.	31392.
1975	2823.	2832.	2835.	2844.	2869.	2910.	2954.	2998.	3043.	3090.	3143.	3201.	35539.
1976	3260.	3313.	3357.	3389.	3419.	3463.	3528.	3595.	3649.	3684.	3697.	3698.	42054.
1977	3701.	3721.	3759.	3814.	3867.	3903.	3928.	3954.	3992.	4047.	4121.	4212.	47018.
AVGE	1839.	1870.	1902.	1934.	1965.	1994.	2023.	2052.	2082.	2115.	2150.	2186.	

TABLE TOTAL- 241122. MEAN- 2009. STD. DEVIATION- 1129.

B 8. UNMODIFIED SI RATIOS

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	AVGE
1968	95.3	89.7	98.0	99.7	110.9	101.6	100.0	95.9	99.2	96.8	108.5	107.7	100.3
1969	90.4	95.5	94.7	95.0	111.4	106.8	99.1	95.5	97.4	100.2	108.1	101.5	99.6
1970	100.2	88.8	96.6	97.4	107.7	101.8	102.9	96.0	101.5	100.5	106.5	101.4	100.1
1971	94.4	91.4	100.0	95.6	105.6	104.4	105.1	97.6	99.3	99.2	104.8	98.6	99.7
1972	98.0	89.8	97.1	100.7	106.2	105.5	101.1	99.3	94.5	100.9	119.2	93.6	100.5
1973	93.2	87.8	97.1	94.3	111.1	111.3	101.4	99.5	97.6	102.2	105.0	96.9	99.8
1974	93.3	88.5	94.6	103.7	112.2	104.8	99.9	100.3	99.2	97.4	108.2	99.3	100.1
1975	93.4	92.5	93.7	100.6	104.0	107.9	102.5	100.1	102.7	100.0	99.4	99.5	99.7
1976	96.1	92.6	96.9	96.2	106.7	106.4	103.1	97.7	101.1	104.7	104.0	97.1	100.2
1977	91.8	92.6	98.4	92.4	110.4	108.5	103.2	97.7	103.7	96.5	105.2	99.8	100.0
AVGE	94.6	90.9	96.7	97.5	108.6	105.9	101.8	98.0	99.6	99.9	106.9	99.5	

TABLE TOTAL- 12000.0 MEAN- 100.0 STD. DEVIATION- 5.7

B 9. REPLACEMENT VALUES FOR EXTREME SI RATIOS

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	S.D.
1968	**********	********	********	********	********	********	********	********	********	********	********	101.3	1.9
1969	95.3	90.2	********	********	********	103.6	********	********	********	********	********	********	1.9
1970	95.3	********	********	********	********	********	********	********	********	********	********	********	1.9
1971	**********	********	********	********	********	********	********	********	********	********	106.6	********	2.1
1972	**********	********	********	********	********	********	********	********	98.6	********	106.9	98.4	2.2
1973	**********	********	********	97.7	********	106.4	********	********	********	********	********	********	2.3
1974	**********	********	********	98.5	109.3	********	********	********	********	********	********	********	2.4
1975	**********	********	********	********	107.9	********	********	********	********	********	105.6	********	2.3
1976	**********	********	********	********	********	********	********	********	********	99.8	********	********	2.3
1977	**********	********	********	97.7	********	********	********	********	********	99.3	********	********	2.0

FINANCE,CHECKS CASHED IN CLEARING CENTERS-BY ACC.PERSONAL CHECKS

B10. SEASONAL FACTORS
3X5 MOVING AVERAGE SELECTED.

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	AVGE
1968	95.1	90.4	97.2	97.7	110.1	103.2	101.1	96.2	99.3	99.4	108.2	101.9	100.0
1969	95.4	90.3	97.4	97.7	109.3	103.3	101.5	96.6	99.5	99.6	108.0	101.3	100.0
1970	95.5	90.1	97.4	97.5	108.8	103.8	102.0	97.1	99.4	100.1	107.5	100.5	100.0
1971	95.5	89.8	97.3	97.8	108.4	104.3	102.1	97.9	99.4	100.4	107.2	99.7	100.0
1972	95.0	89.8	97.0	98.1	108.3	105.1	102.2	98.7	99.4	100.4	106.8	99.1	100.0
1973	94.8	89.9	96.6	98.5	108.2	105.7	102.0	99.2	99.7	100.2	106.5	98.6	100.0
1974	94.3	90.4	96.2	98.5	108.5	106.3	101.9	99.3	100.1	100.0	106.0	98.4	100.0
1975	94.0	90.9	96.0	98.1	108.6	106.7	102.0	99.1	100.8	99.6	105.7	98.5	100.0
1976	93.5	91.5	96.1	97.6	108.6	107.0	102.3	98.7	101.5	99.3	105.2	98.7	100.0
1977	93.5	91.9	96.2	97.2	108.3	107.2	102.5	98.3	101.9	99.2	104.9	98.8	100.0
AVGE	94.7	90.5	96.7	97.9	108.7	105.3	102.0	98.1	100.1	99.8	106.6	99.6	

TABLE TOTAL- 11998.7 MEAN- 100.0 STD. DEVIATION- 5.0

B11. SEASONALLY ADJUSTED SERIES

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
1968	464.	480.	509.	536.	550.	557.	582.	609.	639.	653.	702.	770.	7052.
1969	715.	820.	773.	788.	839.	861.	819.	835.	833.	865.	874.	887.	9909.
1970	939.	887.	897.	911.	916.	925.	975.	974.	1024.	1022.	1022.	1054.	11548.
1971	1045.	1088.	1109.	1067.	1075.	1118.	1160.	1136.	1158.	1174.	1200.	1265.	13594.
1972	1380.	1393.	1441.	1518.	1479.	1546.	1567.	1652.	1616.	1763.	1998.	1701.	19054.
1973	1772.	1768.	1848.	1806.	2001.	2117.	2039.	2086.	2058.	2163.	2120.	2173.	23950.
1974	2275.	2352.	2464.	2725.	2731.	2622.	2609.	2692.	2660.	2649.	2821.	2826.	31426.
1975	2805.	2884.	2768.	2914.	2747.	2944.	2968.	3029.	3103.	3102.	2957.	3230.	35451.
1976	3349.	3356.	3387.	3339.	3361.	3443.	3557.	3561.	3635.	3883.	3657.	3638.	42166.
1977	3636.	3750.	3842.	3627.	3943.	3950.	3953.	3930.	4065.	3935.	4134.	4255.	47020.
AVGE	1838.	1878.	1904.	1923.	1964.	2008.	2023.	2050.	2079.	2121.	2149.	2180.	

TABLE TOTAL- 241169. MEAN- 2010. STD. DEVIATION- 1132.

B13. IRREGULAR SERIES

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	S.D.
1968	100.2	99.2	100.8	102.0	100.7	98.4	98.9	99.6	99.9	97.5	100.2	105.7	2.0
1969	94.8	105.7	97.3	97.2	101.9	103.4	97.6	98.9	97.9	100.6	100.2	100.1	2.9
1970	105.0	98.5	99.2	99.8	99.0	98.0	100.9	98.8	102.1	100.5	99.1	100.9	1.9
1971	98.8	101.8	102.7	97.7	97.4	100.1	102.9	99.7	99.9	98.9	97.8	98.8	1.8
1972	103.1	100.0	100.1	102.6	98.1	100.4	98.9	100.6	95.0	100.5	111.7	94.5	4.2
1973	98.2	97.6	100.6	95.8	102.7	105.4	99.4	100.2	98.0	102.1	98.6	98.2	2.5
1974	98.9	97.9	98.4	105.3	103.5	98.6	98.0	101.0	99.1	97.4	102.0	100.9	2.4
1975	99.4	101.8	97.6	102.5	95.7	101.2	100.5	101.0	102.0	100.4	94.1	100.9	2.5
1976	102.7	101.3	100.9	98.5	98.3	99.4	100.8	99.0	99.6	105.4	98.9	98.4	2.0
1977	98.2	100.8	102.2	95.1	102.0	101.2	100.7	99.4	101.8	97.2	100.3	101.0	2.1
S.D.	2.8	2.3	1.7	3.2	2.4	2.3	1.5	0.8	2.1	2.4	4.3	2.7	

TABLE TOTAL- 12000.7 MEAN- 100.0 STD. DEVIATION- 2.5

FINANCE,CHECKS CASHED IN CLEARING CENTERS-BY ACC.PERSONAL CHECKS

B14. EXTREME IRREGULAR VALUES EXCLUDED FROM TRADING DAY REGRESSION
(OUTSIDE 2.5-SIGMA LIMIT)

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1968	**********	99.2	********	********	********	********	********	********	********	********	********	********
1969	**********	********	********	********	********	********	********	********	********	********	********	********
1970	**********	********	********	********	********	********	********	********	********	********	********	********
1971	**********	********	********	********	********	********	********	********	********	********	********	********
1972	**********	100.0	********	********	********	********	********	********	********	********	111.7	********
1973	**********	********	********	********	********	105.4	********	********	********	********	********	********
1974	**********	********	********	********	********	********	********	********	********	********	********	********
1975	**********	********	********	********	********	********	********	********	********	********	********	********
1976	**********	101.3	********	********	********	********	********	********	********	105.4	********	********
1977	**********	********	********	********	********	********	********	********	********	********	********	********

B15. PRELIM TRADING DAY REGRESSION

	COMBINED WEIGHT	PRIOR WEIGHT	REGRESSION COEFF.	ST.ERROR (COMB.WT.)	T (1)	T (PRIOR WT.)
MONDAY	1.286	1.272	0.014	0.172	1.663	0.080
TUESDAY	1.313	1.071	0.241	0.176	1.776	1.372
WEDNESDAY	1.426	1.674	-0.249	0.173	2.456*	-1.435
THURSDAY	1.321	1.090	0.230	0.180	1.786	1.284
FRIDAY	0.951	0.929	0.022	0.181	-0.270	0.122
SATURDAY	0.276	0.431	-0.155	0.176	-4.109***	-0.879
SUNDAY	0.428	0.532	-0.104	0.174	-3.281**	-0.598

THE STARS INDICATE THE COMBINED WT. IS SIGNIFICANTLY DIFFERENT FROM 1 OR THE PRIOR WT. THE SIGNIFICANCE LEVELS ARE 3 STARS (0.1 PERCENT), 2 STARS (1 PERCENT), 1 STAR (5 PERCENT), AND NO STARS INDICATES NOT SIGNIFICANT AT THE 5 PERCENT LEVEL

SOURCE OF VARIANCE	SUM OF SQUARES	DGRS.OF FREEDOM	MEAN SQUARE	F
REGRESSION	3.143	6	0.524	1.156
ERROR	48.943	108	0.453	
TOTAL	52.086	114		

RESIDUAL TRADING DAY VARIATION NOT PRESENT AT THE 1 PERCENT LEVEL

STANDARD ERRORS OF TRADING DAY ADJUSTMENT FACTORS DERIVED FROM REGRESSION COEFFICIENTS

31-DAY MONTHS-	0.49
30-DAY MONTHS-	0.53
29-DAY MONTHS-	0.59
28-DAY MONTHS-	.00

B16. TRADING DAY ADJUSTMENT FACTORS DERIVED FROM REGRESSION COEFFICIENTS

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	AVGE
1968	100.0	100.8	99.2	100.9	100.0	99.1	100.0	100.3	99.7	100.7	99.6	100.5	100.1
1969	100.0	100.0	99.2	100.0	100.3	99.7	100.7	99.2	100.9	100.0	99.1	100.0	99.9
1970	100.3	100.0	100.5	99.9	99.2	100.9	100.0	99.2	100.0	100.3	99.7	100.7	100.1
1971	99.2	100.0	100.0	100.8	99.2	100.0	100.3	100.5	99.9	99.2	100.9	100.0	100.0
1972	99.2	100.8	100.0	99.1	100.0	100.8	99.2	100.7	99.6	100.5	99.9	99.2	99.9
1973	100.0	100.0	100.3	99.7	100.7	99.6	100.5	100.0	99.1	100.0	100.8	99.2	100.0
1974	100.7	100.0	99.2	100.9	100.0	99.1	100.0	100.3	99.7	100.7	99.6	100.5	100.1
1975	100.0	100.0	99.2	100.0	100.3	99.7	100.7	99.2	100.9	100.0	99.1	100.0	99.9
1976	100.3	99.6	100.0	100.8	99.2	100.0	100.3	100.5	99.9	99.2	100.9	100.0	100.1
1977	99.2	100.0	100.7	99.6	100.5	99.9	99.2	100.0	100.8	99.2	100.0	100.3	100.0
AVGE	99.9	100.1	99.8	100.2	100.0	99.9	100.1	100.0	100.0	100.0	100.0	100.1	

TABLE TOTAL- 12000.4 MEAN- 100.0 STD. DEVIATION- 0.5

FINANCE,CHECKS CASHED IN CLEARING CENTERS-BY ACC.PERSONAL CHECKS

B17. PRELIM WEIGHTS FOR IRREGULAR COMPONENT
GRADUATION RANGE FROM 1.5 TO 2.5 SIGMA

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	S.D.
1968	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	57.0	100.0	0.0	1.7
1969	0.0	0.0	100.0	87.0	100.0	30.5	66.3	100.0	75.4	100.0	100.0	100.0	1.7
1970	18.1	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	1.7
1971	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	2.0
1972	73.2	100.0	100.0	91.8	100.0	100.0	100.0	100.0	46.2	100.0	0.0	34.5	2.2
1973	100.0	100.0	100.0	81.0	100.0	0.5	100.0	100.0	100.0	100.0	100.0	100.0	2.2
1974	100.0	100.0	100.0	58.9	99.1	100.0	100.0	100.0	100.0	100.0	100.0	100.0	2.3
1975	100.0	100.0	100.0	100.0	34.5	100.0	100.0	100.0	100.0	100.0	9.2	100.0	2.3
1976	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	0.0	100.0	100.0	2.1
1977	100.0	100.0	100.0	4.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	1.8

B18. TRADING-DAY ADJUSTMENT FACTORS FROM COMBINED DAILY WEIGHTS

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	AVGE
1968	103.3	103.8	95.7	102.0	102.2	95.7	103.3	98.5	99.0	103.4	97.4	100.1	100.4
1969	102.2	99.1	96.7	102.5	98.5	99.0	103.4	95.7	102.0	102.2	95.7	103.3	100.0
1970	98.5	99.1	100.1	102.5	95.7	102.0	102.2	96.7	102.5	98.5	99.0	103.4	100.0
1971	95.7	99.1	103.3	100.9	96.7	102.5	98.5	100.1	102.5	95.7	102.0	102.2	99.9
1972	96.7	103.8	102.2	95.7	103.3	100.9	96.7	103.4	97.4	100.1	102.5	95.7	99.9
1973	103.3	99.1	98.5	99.0	103.4	97.4	100.1	102.2	95.7	103.3	100.9	96.7	100.0
1974	103.4	99.1	95.7	102.0	102.2	95.7	103.3	98.5	99.0	103.4	97.4	100.1	100.0
1975	102.2	99.1	96.7	102.5	98.5	99.0	103.4	95.7	102.0	102.2	95.7	103.3	100.0
1976	98.5	100.6	103.3	100.9	96.7	102.5	98.5	100.1	102.5	95.7	102.0	102.2	100.3
1977	96.7	99.1	103.4	97.4	100.1	102.5	95.7	103.3	100.9	96.7	102.5	98.5	99.7
AVGE	100.1	100.2	99.6	100.5	99.8	99.7	100.5	99.4	100.4	100.1	99.5	100.6	

TABLE TOTAL- 12003.7 MEAN- 100.0 STD. DEVIATION- 2.7

B19. ADJUSTED* ORIGINAL SERIES
*ADJUSTED BY...TRADING DAY ADJUSTMENT FACTORS DERIVED FROM REGRESSION COEFFICIENTS

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
1968	441.	431.	499.	520.	605.	580.	588.	585.	636.	644.	764.	781.	7073.
1969	682.	741.	759.	770.	914.	893.	826.	812.	822.	862.	952.	898.	9930.
1970	894.	799.	870.	889.	1005.	953.	994.	954.	1018.	1020.	1103.	1052.	11550.
1971	1006.	977.	1079.	1035.	1175.	1166.	1181.	1107.	1151.	1188.	1276.	1262.	13602.
1972	1322.	1240.	1399.	1502.	1601.	1611.	1615.	1619.	1614.	1762.	2134.	1699.	19116.
1973	1680.	1590.	1779.	1784.	2150.	2247.	2070.	2069.	2069.	2166.	2239.	2160.	24004.
1974	2131.	2126.	2389.	2661.	2962.	2812.	2658.	2665.	2670.	2630.	3004.	2769.	31478.
1975	2636.	2620.	2679.	2861.	2974.	3150.	3005.	3025.	3100.	3090.	3153.	3183.	35478.
1976	3123.	3081.	3253.	3233.	3679.	3686.	3627.	3496.	3690.	3889.	3815.	3590.	42161.
1977	3427.	3444.	3672.	3540.	4249.	4237.	4086.	3863.	4107.	3937.	4337.	4189.	47089.
AVGE	1734.	1705.	1838.	1879.	2132.	2134.	2065.	2020.	2088.	2119.	2278.	2158.	

TABLE TOTAL- 241480. MEAN- 2012. STD. DEVIATION- 1143.

FINANCE,CHECKS CASHED IN CLEARING CENTERS-BY ACC.PERSONAL CHECKS

B20. EXTREME VALUES

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	S.D.
1968	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	98.6	100.0	105.2	1.5
1969	94.8	105.7	100.0	99.6	100.0	102.5	98.9	100.0	99.3	100.0	100.0	100.0	2.4
1970	103.8	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	1.1
1971	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	0.0
1972	101.0	100.0	100.0	100.3	100.0	100.0	100.0	100.0	97.5	100.0	111.8	96.8	3.6
1973	100.0	100.0	100.0	99.2	100.0	105.8	100.0	100.0	100.0	100.0	100.0	100.0	1.7
1974	100.0	100.0	100.0	101.8	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	0.5
1975	100.0	100.0	100.0	100.0	97.0	100.0	100.0	100.0	100.0	100.0	95.4	100.0	1.6
1976	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	106.2	100.0	100.0	1.8
1977	100.0	100.0	100.0	95.7	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	1.2
S.D.	2.1	1.8	0.0	1.5	1.0	2.0	0.3	0.0	0.8	2.0	4.0	1.9	

TABLE TOTAL- 12016.8 MEAN- 100.1 STD. DEVIATION- 1.8

C 1. ADJUSTED* ORIGINAL SERIES MODIFIED BY PRELIM WEIGHTS
*ADJUSTED BY...TRADING DAY ADJUSTMENT FACTORS DERIVED FROM REGRESSION COEFFICIENTS

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
1968	441.	431.	499.	520.	605.	580.	588.	585.	636.	653.	764.	743.	7044.
1969	719.	701.	759.	773.	914.	870.	835.	812.	828.	862.	952.	898.	9923.
1970	861.	799.	870.	889.	1005.	953.	994.	954.	1018.	1020.	1103.	1052.	11517.
1971	1006.	977.	1079.	1035.	1175.	1166.	1181.	1107.	1151.	1188.	1276.	1262.	13602.
1972	1309.	1240.	1399.	1498.	1601.	1611.	1615.	1619.	1655.	1762.	1909.	1755.	18972.
1973	1680.	1590.	1779.	1798.	2150.	2124.	2070.	2069.	2069.	2166.	2239.	2160.	23894.
1974	2131.	2126.	2389.	2615.	2961.	2812.	2658.	2665.	2670.	2630.	3004.	2769.	31431.
1975	2636.	2620.	2679.	2861.	3067.	3150.	3005.	3025.	3100.	3090.	3307.	3183.	35724.
1976	3123.	3081.	3253.	3233.	3679.	3686.	3627.	3496.	3690.	3661.	3815.	3590.	41933.
1977	3427.	3444.	3672.	3699.	4249.	4237.	4086.	3863.	4107.	3937.	4337.	4189.	47248.
AVGE	1733.	1701.	1838.	1892.	2141.	2119.	2066.	2020.	2093.	2097.	2271.	2160.	

TABLE TOTAL- 241289. MEAN- 2011. STD. DEVIATION- 1144.

C 2. TREND CYCLE- CENTERED 12-TERM MOVING AVERAGE

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
1968	467.	486.	506.	527.	551.	575.	599.	621.	643.	665.	688.	713.	7042.
1969	736.	755.	773.	790.	806.	820.	833.	843.	852.	861.	870.	877.	9815.
1970	887.	899.	913.	928.	941.	953.	966.	979.	995.	1010.	1023.	1039.	11535.
1971	1056.	1070.	1082.	1095.	1109.	1125.	1146.	1170.	1194.	1227.	1264.	1300.	13837.
1972	1337.	1376.	1418.	1463.	1513.	1560.	1596.	1626.	1657.	1685.	1721.	1765.	18718.
1973	1805.	1843.	1879.	1913.	1944.	1974.	2010.	2051.	2099.	2158.	2226.	2289.	24191.
1974	2342.	2391.	2441.	2485.	2537.	2594.	2640.	2682.	2715.	2737.	2752.	2770.	31086.
1975	2799.	2828.	2861.	2898.	2930.	2960.	2997.	3037.	3080.	3119.	3160.	3208.	35877.
1976	3256.	3302.	3346.	3394.	3439.	3477.	3507.	3535.	3568.	3604.	3648.	3694.	41771.
1977	3736.	3771.	3804.	3832.	3866.	3912.	3961.	4009.	4060.	4117.	4179.	4245.	47492.
AVGE	1842.	1872.	1902.	1933.	1963.	1995.	2026.	2055.	2086.	2118.	2153.	2190.	

TABLE TOTAL- 241363. MEAN- 2011. STD. DEVIATION- 1135.

FINANCE,CHECKS CASHED IN CLEARING CENTERS-BY ACC.PERSONAL CHECKS

C 4. MODIFIED SI RATIOS

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	AVGE
1968	94.5	88.6	98.5	98.6	110.0	100.9	98.2	94.1	98.9	98.3	111.0	104.2	99.6
1969	97.8	92.7	98.2	97.9	113.4	106.1	100.2	96.4	97.2	100.1	109.5	102.4	101.0
1970	97.1	88.8	95.3	95.8	106.8	100.0	102.9	97.4	102.3	101.0	107.7	101.2	99.7
1971	95.2	91.3	99.7	94.5	106.0	103.7	103.1	94.6	96.4	96.8	100.9	97.1	98.3
1972	97.9	90.1	98.6	102.4	105.8	103.3	101.1	99.5	99.9	104.5	111.0	99.4	101.1
1973	93.0	86.3	94.7	94.0	110.6	107.6	103.0	100.9	98.6	100.4	100.6	94.4	98.7
1974	91.0	88.9	97.9	105.2	116.7	108.4	100.7	99.4	98.4	96.1	109.2	99.9	101.0
1975	94.2	92.6	93.6	98.7	104.7	106.4	100.3	99.6	100.7	99.1	104.6	99.2	99.5
1976	95.9	93.3	97.2	95.2	107.0	106.0	103.4	98.9	103.4	101.6	104.6	97.2	100.3
1977	91.7	91.3	96.5	96.5	109.9	108.3	103.2	96.4	101.1	95.6	103.8	98.7	99.4
AVGE	94.8	90.4	97.0	97.9	109.1	105.1	101.6	97.7	99.7	99.3	106.3	99.4	

TABLE TOTAL- 11983.0 MEAN- 99.9 STD. DEVIATION- 5.6

C 5. SEASONAL FACTORS
3X3 MOVING AVERAGE SELECTED.

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	AVGE
1968	96.4	90.4	97.8	97.8	110.7	102.8	99.7	95.1	98.6	98.9	109.3	103.0	100.0
1969	96.5	90.5	97.6	97.1	109.9	102.9	100.7	95.8	98.8	99.3	108.4	102.2	100.0
1970	96.8	90.5	97.7	97.0	108.4	102.8	101.8	96.7	99.4	100.2	107.6	101.0	100.0
1971	96.5	90.2	97.9	97.0	107.7	103.8	102.8	97.8	99.4	100.7	106.0	99.2	99.9
1972	95.7	89.5	97.8	98.5	108.4	104.7	102.4	98.8	99.3	101.0	106.2	98.2	100.1
1973	94.2	89.1	96.8	99.0	109.9	106.5	102.0	99.7	99.0	100.0	105.4	97.7	99.9
1974	93.5	89.8	96.2	99.9	110.4	106.9	101.4	99.6	99.5	99.2	106.0	98.2	100.0
1975	93.5	91.2	95.8	98.6	109.2	107.2	101.8	99.2	100.6	98.7	105.2	98.5	100.0
1976	93.8	92.1	96.4	97.6	108.4	107.0	102.3	98.6	101.7	98.9	105.1	98.6	100.0
1977	93.5	92.2	96.6	96.6	108.4	107.2	103.0	98.3	102.3	99.0	104.5	98.4	100.0
AVGE	95.0	90.5	97.1	97.9	109.1	105.2	101.8	97.9	99.9	99.6	106.4	99.5	

TABLE TOTAL- 11999.2 MEAN- 100.0 STD. DEVIATION- 5.0

C 6. SEASONALLY ADJUSTED SERIES

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
1968	458.	477.	510.	532.	547.	564.	589.	615.	645.	661.	699.	722.	7017.
1969	745.	774.	777.	796.	832.	846.	829.	848.	838.	868.	879.	879.	9911.
1970	890.	883.	891.	916.	927.	927.	976.	987.	1024.	1018.	1024.	1042.	11505.
1971	1042.	1083.	1103.	1067.	1091.	1123.	1150.	1132.	1158.	1179.	1203.	1272.	13603.
1972	1368.	1386.	1431.	1520.	1477.	1539.	1577.	1638.	1666.	1745.	1798.	1787.	18929.
1973	1784.	1785.	1838.	1816.	1956.	1995.	2029.	2077.	2089.	2166.	2123.	2212.	23870.
1974	2278.	2366.	2482.	2619.	2682.	2631.	2622.	2676.	2684.	2652.	2836.	2818.	31347.
1975	2819.	2874.	2796.	2900.	2809.	2938.	2953.	3049.	3082.	3130.	3144.	3233.	35728.
1976	3329.	3343.	3375.	3312.	3393.	3446.	3545.	3546.	3630.	3702.	3630.	3641.	41892.
1977	3665.	3735.	3801.	3830.	3921.	3952.	3968.	3931.	4016.	3979.	4149.	4257.	47205.
AVGE	1838.	1871.	1900.	1931.	1964.	1996.	2024.	2050.	2083.	2110.	2148.	2186.	

TABLE TOTAL- 241006. MEAN- 2008. STD. DEVIATION- 1133.

FINANCE,CHECKS CASHED IN CLEARING CENTERS-BY ACC.PERSONAL CHECKS

C 7. TREND CYCLE - HENDERSON CURVE
9-TERM MOVING AVERAGE SELECTED. I/C RATIO IS 0.69

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
1968	460.	482.	505.	528.	548.	568.	590.	614.	641.	668.	695.	722.	7021.
1969	746.	766.	785.	805.	823.	835.	840.	843.	850.	862.	874.	881.	9909.
1970	884.	889.	896.	908.	923.	943.	968.	991.	1011.	1022.	1028.	1040.	11504.
1971	1057.	1072.	1081.	1089.	1101.	1115.	1132.	1145.	1155.	1178.	1221.	1277.	13622.
1972	1339.	1398.	1444.	1477.	1507.	1539.	1577.	1629.	1687.	1738.	1772.	1789.	18899.
1973	1791.	1794.	1818.	1865.	1926.	1984.	2036.	2074.	2101.	2128.	2160.	2206.	23884.
1974	2279.	2382.	2497.	2588.	2640.	2657.	2650.	2650.	2678.	2723.	2774.	2814.	31333.
1975	2840.	2843.	2839.	2847.	2869.	2911.	2970.	3029.	3079.	3123.	3176.	3240.	35765.
1976	3300.	3337.	3350.	3361.	3393.	3447.	3515.	3581.	3627.	3649.	3653.	3658.	41870.
1977	3679.	3726.	3790.	3854.	3905.	3940.	3955.	3960.	3984.	4043.	4129.	4221.	47185.
AVGE	1837.	1869.	1901.	1932.	1963.	1994.	2023.	2052.	2081.	2113.	2148.	2185.	

TABLE TOTAL- 240990. MEAN- 2008. STD. DEVIATION- 1132.

C 9. MODIFIED SI RATIOS

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	AVGE
1968	96.0	89.3	98.6	98.5	110.5	102.2	99.7	95.1	99.2	97.8	109.8	102.8	100.0
1969	96.4	91.5	96.6	96.0	111.1	104.3	99.4	96.4	97.4	100.0	108.9	102.0	100.0
1970	97.4	89.9	97.1	97.9	108.8	101.0	102.7	96.2	100.7	99.8	107.2	101.1	100.0
1971	95.2	91.1	99.9	95.0	106.8	104.6	104.3	96.7	99.7	100.8	104.5	98.8	99.8
1972	97.7	88.7	96.8	101.4	106.2	104.7	102.4	99.4	98.1	101.3	107.7	98.1	100.2
1973	93.8	88.6	97.8	96.4	111.6	107.0	101.7	99.8	98.5	101.8	103.6	97.9	99.9
1974	93.5	89.2	95.6	101.0	112.2	105.9	100.3	100.5	99.7	96.6	108.3	98.4	100.1
1975	92.8	92.2	94.4	100.5	106.9	108.2	101.2	99.9	100.7	99.0	104.1	98.2	99.8
1976	94.6	92.3	97.1	96.2	108.4	106.9	103.2	97.6	101.8	100.3	104.4	98.2	100.1
1977	93.2	92.4	96.9	96.0	108.8	107.5	103.3	97.6	103.1	97.4	105.0	99.2	100.0
AVGE	95.1	90.5	97.1	97.9	109.1	105.2	101.8	97.9	99.9	99.5	106.4	99.5	

TABLE TOTAL- 11999.1 MEAN- 100.0 STD. DEVIATION- 5.2

C10. SEASONAL FACTORS
3X5 MOVING AVERAGE SELECTED.

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	AVGE
1968	96.1	90.7	97.6	97.6	109.8	102.8	100.7	95.6	98.9	99.1	108.5	102.4	100.0
1969	96.3	90.4	97.7	97.5	109.3	102.9	101.2	96.1	99.1	99.5	108.1	101.7	100.0
1970	96.2	90.2	97.7	97.4	108.9	103.5	101.7	96.8	99.1	100.1	107.4	100.7	100.0
1971	96.1	89.8	97.6	97.7	108.8	104.1	102.1	97.7	99.2	100.3	106.8	99.7	100.0
1972	95.4	89.8	97.2	98.1	108.9	105.0	102.2	98.6	99.3	100.3	106.2	98.9	100.0
1973	94.9	89.9	96.8	98.7	108.9	105.7	102.0	99.1	99.5	100.0	105.9	98.4	100.0
1974	94.2	90.4	96.5	98.6	109.1	106.6	101.9	99.3	100.0	99.6	105.5	98.3	100.0
1975	93.8	90.9	96.3	98.4	109.2	106.9	102.0	99.1	100.6	99.1	105.4	98.4	100.0
1976	93.4	91.6	96.3	97.8	109.0	107.2	102.4	98.6	101.4	98.7	105.0	98.6	100.0
1977	93.4	92.0	96.4	97.4	108.6	107.2	102.8	98.2	101.9	98.7	104.8	98.7	100.0
AVGE	95.0	90.6	97.0	97.9	109.0	105.2	101.9	97.9	99.9	99.5	106.4	99.6	

TABLE TOTAL- 11998.8 MEAN- 100.0 STD. DEVIATION- 5.0

FINANCE,CHECKS CASHED IN CLEARING CENTERS-BY ACC.PERSONAL CHECKS

C11. SEASONALLY ADJUSTED SERIES

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
1968	459.	479.	507.	537.	551.	559.	584.	613.	641.	654.	700.	766.	7052.
1969	708.	819.	770.	789.	839.	864.	822.	839.	836.	866.	873.	884.	9909.
1970	932.	886.	895.	913.	915.	928.	977.	978.	1027.	1022.	1024.	1052.	11548.
1971	1039.	1087.	1107.	1068.	1071.	1121.	1161.	1138.	1160.	1174.	1204.	1266.	13595.
1972	1375.	1393.	1438.	1518.	1471.	1548.	1568.	1654.	1618.	1764.	2009.	1703.	19059.
1973	1771.	1769.	1843.	1802.	1987.	2116.	2039.	2088.	2061.	2167.	2131.	2177.	23951.
1974	2278.	2353.	2456.	2721.	2715.	2615.	2609.	2693.	2664.	2659.	2835.	2831.	31429.
1975	2810.	2882.	2760.	2907.	2732.	2938.	2967.	3030.	3106.	3120.	2966.	3235.	35453.
1976	3352.	3352.	3379.	3333.	3349.	3438.	3554.	3561.	3638.	3907.	3665.	3643.	42172.
1977	3638.	3746.	3835.	3619.	3932.	3949.	3944.	3933.	4066.	3957.	4139.	4259.	47017.
AVGE	1836.	1877.	1899.	1921.	1956.	2008.	2022.	2053.	2082.	2129.	2155.	2182.	

TABLE TOTAL- 241186. MEAN- 2010. STD. DEVIATION- 1132.

C13. IRREGULAR SERIES

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	S.D.
1968	100.0	99.3	100.3	101.8	100.7	98.5	99.0	99.8	100.0	98.0	100.7	106.1	2.0
1969	94.9	107.0	98.1	98.1	102.0	103.6	97.8	99.5	98.4	100.5	99.8	100.3	3.0
1970	105.4	99.7	99.8	100.5	99.2	98.4	101.0	98.6	101.6	100.0	99.6	101.2	1.8
1971	98.3	101.4	102.4	98.0	97.3	100.5	102.5	99.4	100.5	99.7	98.6	99.1	1.6
1972	102.6	99.6	99.6	102.7	97.6	100.5	99.4	101.6	95.9	101.5	113.3	95.2	4.5
1973	98.9	98.6	101.4	96.6	103.2	106.6	100.2	100.7	98.1	101.8	98.7	98.6	2.6
1974	100.0	98.8	98.3	105.1	102.8	98.4	98.5	101.6	99.5	97.7	102.2	100.6	2.2
1975	98.9	101.4	97.2	102.1	95.2	100.9	99.9	100.0	100.9	99.9	93.4	99.8	2.6
1976	101.6	100.5	100.9	99.2	98.7	99.7	101.1	99.4	100.3	107.1	100.3	99.6	2.2
1977	98.9	100.5	101.2	93.9	100.7	100.2	99.7	99.3	102.0	97.9	100.2	100.9	2.1
S.D.	2.7	2.4	1.5	3.1	2.5	2.6	1.3	0.9	1.8	2.6	4.8	2.6	

TABLE TOTAL- 12017.1 MEAN- 100.1 STD. DEVIATION- 2.6

C14. EXTREME IRREGULAR VALUES EXCLUDED FROM TRADING DAY REGRESSION
(OUTSIDE 2.5-SIGMA LIMIT)

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1968	**********	********	********	********	********	********	********	********	********	********	********	********
1969	**********	107.0	********	********	********	********	********	********	********	********	********	********
1970	**********	********	********	********	********	********	********	********	********	********	********	********
1971	**********	********	********	********	********	********	********	********	********	********	********	********
1972	**********	********	********	********	********	********	********	********	********	********	113.3	********
1973	**********	********	********	********	********	106.6	********	********	********	********	********	********
1974	**********	********	********	********	********	********	********	********	********	********	********	********
1975	**********	********	********	********	********	********	********	********	********	********	********	********
1976	**********	********	********	********	********	********	********	********	********	107.1	********	********
1977	**********	********	********	********	********	********	********	********	********	********	********	********

FINANCE,CHECKS CASHED IN CLEARING CENTERS-BY ACC.PERSONAL CHECKS

C15. FINAL TRADING DAY REGRESSION

	COMBINED WEIGHT	PRIOR WEIGHT	REGRESSION COEFF.	ST.ERROR (COMB.WT.)	T (1)	T (PRIOR WT.)
MONDAY	1.315	1.272	0.043	0.152	2.074*	0.283
TUESDAY	1.296	1.071	0.225	0.154	1.927	1.464
WEDNESDAY	1.408	1.674	-0.266	0.153	2.660**	-1.738
THURSDAY	1.357	1.090	0.267	0.156	2.284*	1.707
FRIDAY	0.930	0.929	0.001	0.161	-0.437	0.003
SATURDAY	0.238	0.431	-0.193	0.157	-4.848***	-1.228
SUNDAY	0.456	0.532	-0.076	0.152	-3.573***	-0.499

THE STARS INDICATE THE COMBINED WT. IS SIGNIFICANTLY DIFFERENT FROM 1 OR THE PRIOR WT. THE SIGNIFICANCE LEVELS ARE 3 STARS (0.1 PERCENT), 2 STARS (1 PERCENT), 1 STAR (5 PERCENT), AND NO STARS INDICATES NOT SIGNIFICANT AT THE 5 PERCENT LEVEL

SOURCE OF VARIANCE	SUM OF SQUARES	DGRS.OF FREEDOM	MEAN SQUARE	F
REGRESSION	3.559	6	0.593	1.609
ERROR	40.554	110	0.369	
TOTAL	44.113	116		

RESIDUAL TRADING DAY VARIATION NOT PRESENT AT THE 1 PERCENT LEVEL

STANDARD ERRORS OF TRADING DAY ADJUSTMENT FACTORS DERIVED FROM REGRESSION COEFFICIENTS

31-DAY MONTHS-	0.43
30-DAY MONTHS-	0.47
29-DAY MONTHS-	0.52
28-DAY MONTHS-	.00

C16. TRADING DAY ADJUSTMENT FACTORS DERIVED FROM REGRESSION COEFFICIENTS

C16A. REGRESSION COEFFICIENTS -

MON	TUE	WED	THUR	FRI	SAT	SUN
1.043	1.225	0.734	1.267	1.001	0.807	0.924

C16B. REGRESSION TRADING DAY ADJUSTMENT FACTORS

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	AVGE
1968	100.00	100.92	99.13	100.89	100.00	99.10	100.00	100.24	99.89	100.73	99.36	100.62	100.07
1969	100.00	100.00	99.27	99.86	100.24	99.89	100.73	99.13	100.89	100.00	99.10	100.00	99.93
1970	100.24	100.00	100.62	100.00	99.13	100.89	100.00	99.27	99.86	100.24	99.89	100.73	100.07
1971	99.13	100.00	100.00	100.89	99.27	99.86	100.24	100.62	100.00	99.13	100.89	100.00	100.00
1972	99.27	100.78	100.00	99.10	100.00	100.89	99.27	100.73	99.36	100.62	100.00	99.13	99.93
1973	100.00	100.00	100.24	99.89	100.73	99.36	100.62	100.00	99.10	100.00	100.89	99.27	100.01
1974	100.73	100.00	99.13	100.89	100.00	99.10	100.00	100.24	99.89	100.73	99.36	100.62	100.06
1975	100.00	100.00	99.27	99.86	100.24	99.89	100.73	99.13	100.89	100.00	99.10	100.00	99.93
1976	100.24	99.74	100.00	100.89	99.27	99.86	100.24	100.62	100.00	99.13	100.89	100.00	100.07
1977	99.27	100.00	100.73	99.36	100.62	100.00	99.13	100.00	100.89	99.27	99.86	100.24	99.95
AVGE	99.89	100.14	99.84	100.16	99.95	99.89	100.10	100.00	100.08	99.99	99.94	100.06	

TABLE TOTAL- 12000.35 MEAN- 100.00 STD. DEVIATION- 0.57

C16C. REGRESSION TRADING DAY ADJUSTMENT FACTORS, ONE YEAR AHEAD

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	AVGE
1978	100.62	100.00	100.00	99.10	100.00	100.89	99.27	100.73	99.36	100.62	100.00	99.13	99.98

C17. FINAL WEIGHTS FOR IRREGULAR COMPONENT

GRADUATION RANGE FROM 1.5 TO 2.5 SIGMA

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	S.D.
1968	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	0.0	1.4
1969	0.0	0.0	100.0	100.0	100.0	3.1	99.5	100.0	100.0	100.0	100.0	100.0	1.4
1970	0.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	1.4
1971	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	1.8
1972	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	59.7	100.0	0.0	28.3	2.1
1973	100.0	100.0	100.0	94.5	100.0	0.0	100.0	100.0	100.0	100.0	100.0	100.0	2.2
1974	100.0	100.0	100.0	5.4	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	2.2
1975	100.0	100.0	100.0	100.0	0.0	100.0	100.0	100.0	100.0	100.0	0.0	100.0	2.1
1976	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	0.0	100.0	100.0	1.9
1977	100.0	100.0	100.0	0.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	1.5

FINANCE,CHECKS CASHED IN CLEARING CENTERS-BY ACC.PERSONAL CHECKS

C20. EXTREME VALUES

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	S.D.
1968	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	106.1	1.8
1969	94.9	107.0	100.0	100.0	100.0	103.5	100.0	100.0	100.0	100.0	100.0	100.0	2.7
1970	105.4	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	1.6
1971	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	0.0
1972	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	98.3	100.0	113.3	96.5	4.0
1973	100.0	100.0	100.0	99.8	100.0	106.6	100.0	100.0	100.0	100.0	100.0	100.0	1.9
1974	100.0	100.0	100.0	104.9	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	1.4
1975	100.0	100.0	100.0	100.0	95.2	100.0	100.0	100.0	100.0	100.0	93.4	100.0	2.4
1976	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	107.1	100.0	100.0	2.0
1977	100.0	100.0	100.0	93.9	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	1.8
S.D.	2.3	2.2	0.0	2.5	1.5	2.4	0.0	0.0	0.5	2.2	4.7	2.2	

TABLE TOTAL- 12025.8 MEAN- 100.2 STD. DEVIATION- 2.2

D 1. ORIGINAL SERIES MODIFIED BY FINAL WEIGHTS

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
1968	442.	434.	495.	524.	605.	575.	588.	586.	634.	649.	760.	740.	7032.
1969	718.	692.	753.	770.	917.	860.	832.	806.	829.	862.	944.	899.	9880.
1970	851.	799.	875.	888.	997.	961.	994.	946.	1018.	1023.	1099.	1059.	11510.
1971	998.	977.	1080.	1043.	1166.	1166.	1185.	1112.	1151.	1178.	1286.	1262.	13603.
1972	1311.	1251.	1399.	1488.	1601.	1625.	1602.	1630.	1634.	1770.	1882.	1746.	18939.
1973	1680.	1590.	1785.	1782.	2165.	2098.	2080.	2070.	2051.	2167.	2258.	2143.	23867.
1974	2146.	2126.	2370.	2559.	2963.	2787.	2659.	2673.	2662.	2649.	2991.	2782.	31367.
1975	2636.	2620.	2658.	2860.	3133.	3140.	3026.	3001.	3126.	3091.	3346.	3184.	35822.
1976	3133.	3069.	3253.	3260.	3649.	3685.	3639.	3513.	3688.	3603.	3847.	3591.	41930.
1977	3399.	3444.	3697.	3753.	4270.	4234.	4054.	3864.	4141.	3905.	4336.	4203.	47302.
AVGE	1731.	1700.	1836.	1893.	2147.	2113.	2066.	2020.	2093.	2090.	2275.	2161.	

TABLE TOTAL- 241252. MEAN- 2010. STD. DEVIATION- 1146.

D 2. TREND CYCLE- CENTERED 12-TERM MOVING AVERAGE

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
1968	467.	486.	506.	527.	550.	574.	597.	620.	641.	662.	686.	710.	7025.
1969	732.	752.	769.	786.	803.	817.	829.	839.	848.	858.	867.	874.	9774.
1970	885.	898.	911.	926.	939.	952.	965.	979.	995.	1010.	1023.	1039.	11523.
1971	1055.	1070.	1083.	1095.	1109.	1125.	1147.	1171.	1196.	1228.	1264.	1302.	13845.
1972	1338.	1377.	1419.	1464.	1513.	1558.	1594.	1623.	1653.	1682.	1717.	1760.	18698.
1973	1800.	1838.	1874.	1908.	1940.	1972.	2008.	2050.	2097.	2154.	2219.	2281.	24143.
1974	2334.	2383.	2434.	2479.	2530.	2587.	2634.	2675.	2708.	2732.	2752.	2774.	31024.
1975	2804.	2833.	2866.	2904.	2937.	2968.	3006.	3045.	3089.	3130.	3168.	3213.	35963.
1976	3261.	3308.	3352.	3397.	3439.	3477.	3505.	3532.	3566.	3605.	3652.	3700.	41795.
1977	3741.	3772.	3806.	3837.	3870.	3916.	3968.	4018.	4068.	4119.	4176.	4244.	47535.
AVGE	1842.	1872.	1902.	1932.	1963.	1995.	2025.	2055.	2086.	2118.	2152.	2190.	

TABLE TOTAL- 241325. MEAN- 2011. STD. DEVIATION- 1136.

FINANCE,CHECKS CASHED IN CLEARING CENTERS-BY ACC.PERSONAL CHECKS

D 4. MODIFIED SI RATIOS

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	AVGE
1968	94.6	89.4	97.8	99.5	110.2	100.1	98.4	94.6	98.9	97.9	110.9	104.2	99.7
1969	98.0	92.1	97.9	98.0	114.3	105.3	100.3	96.1	97.7	100.4	108.9	102.8	101.0
1970	96.2	89.0	95.9	95.9	106.1	100.9	103.0	96.7	102.3	101.3	107.4	102.0	99.7
1971	94.5	91.3	99.7	95.3	105.1	103.6	103.3	95.0	96.2	96.0	101.7	96.9	98.2
1972	98.0	90.8	98.6	101.7	105.8	104.3	100.5	100.4	98.8	105.3	109.6	99.2	101.1
1973	93.3	86.5	95.2	93.4	111.6	106.4	103.6	101.0	97.8	100.6	101.7	93.9	98.7
1974	92.0	89.2	97.4	103.2	117.1	107.7	100.9	99.9	98.3	96.9	108.7	100.3	101.0
1975	94.0	92.5	92.7	98.5	106.7	105.8	100.7	98.6	101.2	98.7	105.6	99.1	99.5
1976	96.1	92.8	97.0	96.0	106.1	106.0	103.8	99.5	103.4	99.9	105.4	97.0	100.2
1977	90.9	91.3	97.1	97.8	110.3	108.1	102.2	96.2	101.8	94.8	103.8	99.0	99.4
AVGE	94.8	90.5	96.9	97.9	109.3	104.8	101.7	97.8	99.6	99.2	106.4	99.4	

TABLE TOTAL- 11983.6 MEAN- 99.9 STD. DEVIATION- 5.6

D 5. SEASONAL FACTORS
3X3 MOVING AVERAGE SELECTED.

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	AVGE
1968	96.4	90.5	97.5	98.2	111.1	102.3	99.6	95.4	98.6	99.0	109.0	102.9	100.0
1969	96.3	90.5	97.5	97.5	110.0	102.7	100.8	95.7	98.9	99.4	108.2	102.4	100.0
1970	96.4	90.5	97.8	97.3	108.2	102.9	101.9	96.6	99.4	100.2	107.4	101.2	100.0
1971	96.1	90.4	98.0	97.1	107.5	104.0	102.8	97.9	99.0	100.8	106.0	99.2	99.9
1972	95.6	89.8	97.9	98.2	108.4	104.8	102.4	99.2	98.7	101.2	106.1	98.1	100.0
1973	94.4	89.4	96.8	98.3	110.4	106.0	102.2	99.9	98.6	100.3	105.6	97.5	100.0
1974	93.9	90.0	96.0	99.0	111.1	106.4	101.7	99.7	99.3	99.3	106.2	98.2	100.1
1975	93.6	91.1	95.5	98.4	109.9	106.7	102.0	99.1	100.7	98.4	105.7	98.4	100.0
1976	93.8	92.0	96.2	97.8	108.7	106.8	102.4	98.5	102.0	98.1	105.6	98.6	100.0
1977	93.3	92.0	96.7	97.0	108.5	107.3	102.8	98.2	102.6	97.9	105.0	98.4	100.0
AVGE	95.0	90.6	97.0	97.9	109.4	105.0	101.9	98.0	99.8	99.5	106.5	99.5	

TABLE TOTAL- 11999.2 MEAN- 100.0 STD. DEVIATION- 5.1

D 6. SEASONALLY ADJUSTED SERIES

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
1968	458.	480.	507.	534.	545.	562.	590.	615.	643.	655.	697.	719.	7005.
1969	746.	765.	772.	790.	834.	838.	825.	842.	838.	867.	872.	878.	9866.
1970	883.	882.	894.	913.	921.	934.	975.	980.	1024.	1021.	1023.	1046.	11498.
1971	1038.	1081.	1101.	1075.	1085.	1121.	1153.	1137.	1162.	1169.	1213.	1272.	13606.
1972	1371.	1392.	1429.	1516.	1477.	1550.	1564.	1643.	1655.	1749.	1774.	1779.	18900.
1973	1779.	1779.	1845.	1813.	1960.	1978.	2036.	2072.	2081.	2160.	2138.	2198.	23838.
1974	2285.	2363.	2469.	2585.	2667.	2621.	2615.	2680.	2680.	2667.	2817.	2834.	31282.
1975	2816.	2877.	2782.	2908.	2851.	2943.	2967.	3028.	3103.	3142.	3167.	3234.	35818.
1976	3341.	3338.	3382.	3335.	3356.	3450.	3555.	3565.	3617.	3674.	3644.	3641.	41897.
1977	3643.	3743.	3825.	3870.	3936.	3947.	3943.	3934.	4036.	3990.	4128.	4269.	47263.
AVGE	1836.	1870.	1901.	1934.	1963.	1994.	2022.	2050.	2084.	2109.	2147.	2187.	

TABLE TOTAL- 240973. MEAN- 2008. STD. DEVIATION- 1135.

FINANCE,CHECKS CASHED IN CLEARING CENTERS-BY ACC.PERSONAL CHECKS

D 7. TREND CYCLE - HENDERSON CURVE
9-TERM MOVING AVERAGE SELECTED. I/C RATIO IS 0.68

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
1968	460.	483.	506.	527.	547.	567.	589.	613.	639.	665.	693.	720.	7008.
1969	742.	761.	780.	800.	819.	830.	836.	839.	847.	860.	871.	877.	9862.
1970	882.	887.	895.	907.	923.	943.	966.	990.	1010.	1022.	1029.	1040.	11495.
1971	1056.	1071.	1081.	1089.	1100.	1116.	1133.	1146.	1156.	1178.	1222.	1280.	13629.
1972	1343.	1401.	1445.	1478.	1508.	1540.	1577.	1627.	1682.	1730.	1762.	1779.	18871.
1973	1784.	1792.	1819.	1865.	1924.	1981.	2031.	2070.	2097.	2126.	2159.	2208.	23857.
1974	2278.	2374.	2482.	2568.	2621.	2644.	2645.	2651.	2679.	2724.	2776.	2815.	31256.
1975	2838.	2841.	2842.	2858.	2885.	2925.	2977.	3032.	3086.	3136.	3190.	3250.	35861.
1976	3307.	3343.	3352.	3360.	3390.	3447.	3518.	3583.	3625.	3642.	3644.	3651.	41861.
1977	3677.	3735.	3810.	3878.	3919.	3939.	3949.	3959.	3987.	4049.	4135.	4231.	47267.
AVGE	1837.	1869.	1901.	1933.	1964.	1993.	2022.	2051.	2081.	2113.	2148.	2185.	

TABLE TOTAL- 240967. MEAN- 2008. STD. DEVIATION- 1134.

D 8. FINAL UNMODIFIED SI RATIOS

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	AVGE
1968	96.0	89.9	97.8	99.4	110.7	101.4	99.8	95.6	99.3	97.5	109.8	109.1	100.5
1969	91.9	97.3	96.5	96.2	112.0	107.1	99.5	96.0	97.8	100.2	108.4	102.4	100.5
1970	101.7	90.1	97.7	97.9	108.0	102.0	102.8	95.6	100.8	100.1	106.8	101.8	100.4
1971	94.5	91.2	99.9	95.8	106.0	104.5	104.6	97.0	99.5	100.0	105.2	98.6	99.7
1972	97.6	89.3	96.8	100.7	106.2	105.5	101.5	100.2	95.5	102.3	121.0	94.7	101.0
1973	94.2	88.7	98.1	95.4	112.5	112.9	102.4	100.0	97.8	101.9	104.5	97.1	100.5
1974	94.2	89.5	95.5	104.5	113.0	105.4	100.5	100.9	99.4	97.2	107.8	98.8	100.6
1975	92.9	92.2	93.5	100.1	103.4	107.4	101.6	99.0	101.3	98.6	98.0	97.9	98.8
1976	94.7	91.8	97.0	97.0	107.6	106.9	103.4	98.1	101.7	105.9	105.6	98.4	100.7
1977	92.4	92.2	97.0	90.9	109.0	107.5	102.7	97.6	103.9	96.5	104.9	99.3	99.5
AVGE	95.0	91.2	97.0	97.8	108.9	106.1	101.9	98.0	99.7	100.0	107.2	99.8	

TABLE TOTAL- 12025.5 MEAN- 100.2 STD. DEVIATION- 5.8

TEST FOR THE PRESENCE OF SEASONALITY ASSUMING STABILITY

	SUM OF SQUARES	DGRS.OF FREEDOM	MEAN SQUARE	F-VALUE
BETWEEN MONTHS	2895.7785	11	263.25259	26.112**
RESIDUAL	1088.8380	108	10.08183	
TOTAL	3984.6165	119		

**SEASONALITY PRESENT AT THE 0.1 PER CENT LEVEL

NONPARAMETRIC TEST FOR THE PRESENCE OF SEASONALITY ASSUMING STABILITY

KRUSKAL-WALLIS STATISTIC	DEGREES OF FREEDOM	PROBABILITY LEVEL
87.9504	11	0.000%

SEASONALITY PRESENT AT THE ONE PERCENT LEVEL

MOVING SEASONALITY TEST

	SUM OF SQUARES	DGRS.OF FREEDOM	MEAN SQUARE	F-VALUE
BETWEEN YEARS	47.2804	9	5.253381	0.783
ERROR	664.2928	99	6.710028	

NO EVIDENCE OF MOVING SEASONALITY AT THE FIVE PERCENT LEVEL

COMBINED TEST FOR THE PRESENCE OF IDENTIFIABLE SEASONALITY

IDENTIFIABLE SEASONALITY PRESENT

FINANCE,CHECKS CASHED IN CLEARING CENTERS-BY ACC.PERSONAL CHECKS

D 9. FINAL REPLACEMENT VALUES FOR EXTREME SI RATIOS

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1968	**********	********	********	********	********	********	********	********	********	********	********	102.8
1969	96.8	91.0	********	********	********	103.6	99.5	********	********	********	********	********
1970	96.5	********	********	********	********	********	********	********	********	********	********	********
1971	**********	********	********	********	********	********	********	********	********	********	********	********
1972	**********	********	********	********	********	********	********	********	97.1	********	106.8	98.1
1973	**********	********	********	95.5	********	105.9	********	********	********	********	********	********
1974	**********	********	********	99.6	********	********	********	********	********	********	********	********
1975	**********	********	********	********	108.6	********	********	********	********	********	104.9	********
1976	**********	********	********	********	********	********	********	********	********	98.9	********	********
1977	**********	********	********	96.8	********	********	********	********	********	********	********	********

D 9A. YEAR TO YEAR CHANGE IN IRREGULAR AND SEASONAL COMPONENTS AND MOVING SEASONALITY RATIO

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
I	1.694	1.464	1.832	3.016	2.531	1.290	1.552	0.991	1.469	1.554	1.707	0.841
S	0.336	0.243	0.357	0.300	0.500	0.460	0.362	0.524	0.278	0.349	0.356	0.582
RATIO	5.04	6.02	5.13	10.04	5.06	2.80	4.28	1.89	5.29	4.45	4.79	1.45

D10. FINAL SEASONAL FACTORS
3X5 MOVING AVERAGE SELECTED.

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	AVGE
1968	95.97	90.73	97.51	97.72	109.91	102.77	100.58	95.74	98.92	99.22	108.34	102.47	99.99
1969	96.07	90.56	97.63	97.73	109.24	102.98	101.14	96.17	99.03	99.58	107.92	101.79	99.99
1970	96.00	90.33	97.74	97.49	108.84	103.54	101.73	96.91	98.94	100.17	107.24	100.77	99.97
1971	95.87	90.00	97.62	97.63	108.79	104.08	102.10	97.86	98.88	100.50	106.72	99.78	99.99
1972	95.32	89.96	97.29	97.75	109.04	104.88	102.27	98.69	98.92	100.49	106.19	98.88	99.97
1973	94.92	90.06	96.78	98.23	109.28	105.52	102.17	99.29	99.18	100.10	106.04	98.36	99.99
1974	94.34	90.46	96.34	98.21	109.64	106.19	102.08	99.40	99.78	99.50	105.79	98.17	99.99
1975	93.95	90.91	96.13	98.10	109.73	106.60	102.09	99.16	100.60	98.82	105.66	98.35	100.01
1976	93.48	91.47	96.15	97.75	109.40	107.02	102.33	98.70	101.49	98.30	105.32	98.53	99.99
1977	93.38	91.81	96.33	97.52	108.87	107.27	102.56	98.36	101.98	98.17	105.11	98.65	100.00
AVGE	94.93	90.63	96.95	97.81	109.28	105.08	101.90	98.03	99.77	99.49	106.43	99.58	

TABLE TOTAL- 11998.83 MEAN- 99.99 STD. DEVIATION- 5.00

D10A. SEASONAL FACTORS, ONE YEAR AHEAD

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	AVGE
1978	93.35	91.95	96.56	97.21	108.57	107.40	102.76	98.14	102.24	98.23	104.91	98.66	100.00

D11. FINAL SEASONALLY ADJUSTED SERIES

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
1968	460.	478.	507.	536.	551.	559.	584.	613.	641.	654.	702.	766.	7052.
1969	710.	818.	771.	788.	840.	864.	822.	838.	837.	865.	874.	883.	9909.
1970	934.	885.	895.	911.	916.	928.	977.	977.	1029.	1021.	1025.	1051.	11548.
1971	1041.	1085.	1106.	1069.	1072.	1120.	1161.	1137.	1164.	1172.	1205.	1265.	13595.
1972	1376.	1390.	1438.	1523.	1469.	1549.	1566.	1652.	1624.	1762.	2008.	1704.	19060.
1973	1770.	1765.	1844.	1811.	1981.	2120.	2036.	2084.	2068.	2165.	2129.	2179.	23951.
1974	2275.	2350.	2460.	2732.	2702.	2625.	2605.	2690.	2668.	2662.	2827.	2834.	31429.
1975	2806.	2882.	2764.	2915.	2719.	2946.	2965.	3027.	3108.	3128.	2958.	3237.	35454.
1976	3351.	3356.	3384.	3335.	3335.	3444.	3556.	3559.	3634.	3924.	3653.	3644.	42175.
1977	3640.	3752.	3838.	3614.	3922.	3947.	3953.	3929.	4061.	3978.	4125.	4260.	47019.
AVGE	1836.	1876.	1901.	1923.	1951.	2010.	2022.	2050.	2083.	2133.	2151.	2182.	

TABLE TOTAL- 241193. MEAN- 2010. STD. DEVIATION- 1132.

TEST FOR THE PRESENCE OF RESIDUAL SEASONALITY

NO EVIDENCE OF RESIDUAL SEASONALITY IN THE ENTIRE SERIES AT THE 1 PER CENT LEVEL. F = 0.17

NO EVIDENCE OF RESIDUAL SEASONALITY IN THE LAST 3 YEARS AT THE 1 PER CENT LEVEL. F = 0.68

NO EVIDENCE OF RESIDUAL SEASONALITY IN THE LAST 3 YEARS AT THE 5 PER CENT LEVEL.

NOTE: SUDDEN LARGE CHANGES IN THE LEVEL OF THE SEASONALLY ADJUSTED SERIES WILL INVALIDATE THE RESULTS OF THIS TEST FOR THE LAST THREE YEAR PERIOD.

FINANCE,CHECKS CASHED IN CLEARING CENTERS-BY ACC.PERSONAL CHECKS

D12. FINAL TREND CYCLE - HENDERSON CURVE
9-TERM MOVING AVERAGE SELECTED. I/C RATIO IS 0.81

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
1968	460.	483.	507.	529.	548.	566.	586.	610.	637.	665.	695.	723.	7010.
1969	744.	761.	780.	801.	819.	830.	834.	836.	845.	860.	873.	881.	9861.
1970	885.	890.	895.	905.	919.	939.	964.	990.	1011.	1024.	1032.	1044.	11498.
1971	1060.	1075.	1080.	1085.	1095.	1113.	1135.	1150.	1158.	1177.	1219.	1276.	13622.
1972	1343.	1403.	1449.	1479.	1508.	1539.	1578.	1631.	1688.	1733.	1760.	1771.	18881.
1973	1772.	1782.	1817.	1871.	1935.	1992.	2038.	2073.	2096.	2121.	2150.	2194.	23843.
1974	2263.	2364.	2485.	2582.	2638.	2656.	2648.	2646.	2675.	2723.	2776.	2815.	31272.
1975	2835.	2836.	2839.	2858.	2887.	2928.	2979.	3030.	3082.	3131.	3189.	3254.	35849.
1976	3317.	3353.	3356.	3356.	3381.	3439.	3514.	3584.	3629.	3645.	3646.	3654.	41875.
1977	3682.	3739.	3808.	3872.	3910.	3935.	3952.	3966.	3993.	4049.	4128.	4221.	47256.
AVGE	1836.	1869.	1902.	1934.	1964.	1994.	2023.	2052.	2081.	2113.	2147.	2183.	

TABLE TOTAL- 240968. MEAN- 2008. STD. DEVIATION- 1134.

D13. FINAL IRREGULAR SERIES

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	S.D.
1968	99.9	99.0	100.0	101.3	100.5	98.7	99.7	100.5	100.7	98.2	101.0	106.1	2.0
1969	95.4	107.5	98.9	98.4	102.5	104.1	98.6	100.2	99.0	100.7	100.2	100.2	3.0
1970	105.5	99.4	99.9	100.7	99.7	98.9	101.3	98.7	101.7	99.7	99.3	100.7	1.8
1971	98.1	101.0	102.4	98.5	97.8	100.7	102.3	98.8	100.5	99.6	98.9	99.1	1.5
1972	102.5	99.1	99.2	102.9	97.4	100.7	99.2	101.3	96.2	101.7	114.1	96.2	4.6
1973	99.8	99.1	101.5	96.8	102.4	106.4	99.9	100.6	98.6	102.0	99.0	99.3	2.4
1974	100.5	99.4	99.0	105.8	102.4	98.8	98.4	101.6	99.7	97.8	101.8	100.7	2.2
1975	99.0	101.6	97.4	102.0	94.2	100.6	99.5	99.9	100.8	99.9	92.7	99.5	2.9
1976	101.0	100.1	100.8	99.4	98.7	100.1	101.2	99.3	100.1	107.7	100.2	99.7	2.3
1977	98.8	100.4	100.8	93.3	100.3	100.3	100.0	99.1	101.7	98.2	99.9	100.9	2.1
S.D.	2.6	2.5	1.4	3.3	2.6	2.5	1.2	1.0	1.6	2.8	5.1	2.3	

TABLE TOTAL- 12025.8 MEAN- 100.2 STD. DEVIATION- 2.6

D16. COMBINED SEASONAL AND TRADING DAY FACTORS

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	AVGE
1968	99.12	93.42	94.03	98.84	112.37	99.21	103.88	94.04	98.27	101.89	106.03	102.05	100.26
1969	98.22	89.76	95.22	100.16	107.31	102.30	103.87	92.74	100.16	101.81	104.19	105.14	100.07
1970	94.30	89.53	97.34	99.97	104.95	104.72	104.01	94.52	101.40	98.40	106.54	103.49	99.93
1971	92.45	89.20	100.83	97.69	106.11	106.67	100.29	97.47	101.40	96.91	107.94	102.01	99.91
1972	92.97	92.57	99.47	94.37	112.62	104.95	99.75	101.35	96.81	100.08	108.89	95.35	99.93
1973	98.04	89.27	95.06	97.59	112.23	103.27	101.75	101.51	95.75	103.38	106.11	95.93	99.99
1974	96.88	89.66	92.90	99.33	112.10	102.52	105.43	97.64	99.13	102.19	103.53	97.77	99.92
1975	96.05	90.10	93.76	100.53	107.79	105.91	104.84	95.62	101.75	101.03	102.01	101.58	100.08
1976	91.82	92.38	99.31	97.82	106.70	109.67	100.52	98.30	104.07	94.79	106.52	100.73	100.22
1977	91.08	91.00	98.93	95.44	108.43	110.01	98.89	101.59	102.05	95.75	107.72	96.90	99.81
AVGE	95.09	90.69	96.68	98.17	109.06	104.92	102.32	97.48	100.08	99.62	105.95	100.10	

TABLE TOTAL- 12001.72 MEAN- 100.01 STD. DEVIATION- 5.48

D16A. COMBINED SEASONAL AND TRADING DAY FACTORS, ONE YEAR AHEAD

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	AVGE
1978	92.97	91.14	98.72	93.85	112.13	107.47	100.23	100.78	100.06	97.84	107.59	95.14	99.83

FINANCE,CHECKS CASHED IN CLEARING CENTERS-BY ACC.PERSONAL CHECKS

E 1. ORIGINAL SERIES MODIFIED FOR EXTREMES WITH ZERO FINAL WEIGHTS

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
1968	456.	447.	477.	530.	619.	555.	607.	576.	630.	666.	744.	737.	7044.
1969	731.	683.	734.	789.	901.	884.	854.	777.	838.	881.	911.	928.	9911.
1970	835.	792.	871.	911.	961.	972.	1016.	923.	1043.	1005.	1092.	1088.	11509.
1971	962.	968.	1115.	1044.	1137.	1195.	1164.	1108.	1180.	1136.	1301.	1290.	13600.
1972	1279.	1287.	1430.	1437.	1654.	1626.	1562.	1674.	1572.	1763.	1916.	1625.	18825.
1973	1735.	1576.	1753.	1767.	2223.	2057.	2072.	2116.	1980.	2238.	2259.	2090.	23866.
1974	2204.	2107.	2285.	2714.	3029.	2691.	2746.	2626.	2645.	2720.	2927.	2771.	31465.
1975	2695.	2597.	2592.	2931.	3112.	3120.	3108.	2894.	3162.	3160.	3253.	3288.	35912.
1976	3077.	3100.	3360.	3262.	3559.	3777.	3574.	3499.	3782.	3456.	3891.	3671.	42008.
1977	3315.	3414.	3797.	3695.	4253.	4342.	3909.	3991.	4144.	3809.	4444.	4128.	47241.
AVGE	1729.	1697.	1841.	1908.	2145.	2122.	2061.	2018.	2098.	2083.	2274.	2162.	

TABLE TOTAL- 241381. MEAN- 2012. STD. DEVIATION- 1148.

E 2. FINAL SEASONALLY ADJUSTED SERIES MODIFIED FOR EXTREMES WITH ZERO WEIGHTS

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
1968	460.	478.	507.	536.	551.	559.	584.	613.	641.	654.	702.	723.	7008.
1969	744.	761.	771.	788.	840.	864.	822.	838.	837.	865.	874.	883.	9886.
1970	885.	885.	895.	911.	916.	928.	977.	977.	1029.	1021.	1025.	1051.	11499.
1971	1041.	1085.	1106.	1069.	1072.	1120.	1161.	1137.	1164.	1172.	1205.	1265.	13595.
1972	1376.	1390.	1438.	1523.	1469.	1549.	1566.	1652.	1624.	1762.	1760.	1704.	18811.
1973	1770.	1765.	1844.	1811.	1981.	1992.	2036.	2084.	2068.	2165.	2129.	2179.	23824.
1974	2275.	2350.	2460.	2732.	2702.	2625.	2605.	2690.	2668.	2662.	2827.	2834.	31429.
1975	2806.	2882.	2764.	2915.	2887.	2946.	2965.	3027.	3108.	3128.	3189.	3237.	35853.
1976	3351.	3356.	3384.	3335.	3335.	3444.	3556.	3559.	3634.	3645.	3653.	3644.	41896.
1977	3640.	3752.	3838.	3872.	3922.	3947.	3953.	3929.	4061.	3978.	4125.	4260.	47277.
AVGE	1835.	1870.	1901.	1949.	1967.	1998.	2022.	2050.	2083.	2105.	2149.	2178.	

TABLE TOTAL- 241079. MEAN- 2009. STD. DEVIATION- 1136.

E 3. MODIFIED IRREGULAR SERIES

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	S.D.
1968	99.9	99.0	100.0	101.3	100.5	98.7	99.7	100.5	100.7	98.2	101.0	100.0	0.9
1969	100.0	100.0	98.9	98.4	102.5	104.1	98.6	100.2	99.0	100.7	100.2	100.2	1.6
1970	100.0	99.4	99.9	100.7	99.7	98.9	101.3	98.7	101.7	99.7	99.3	100.7	0.9
1971	98.1	101.0	102.4	98.5	97.8	100.7	102.3	98.8	100.5	99.6	98.9	99.1	1.5
1972	102.5	99.1	99.2	102.9	97.4	100.7	99.2	101.3	96.2	101.7	100.0	96.2	2.2
1973	99.8	99.1	101.5	96.8	102.4	100.0	99.9	100.6	98.6	102.0	99.0	99.3	1.5
1974	100.5	99.4	99.0	105.8	102.4	98.8	98.4	101.6	99.7	97.8	101.8	100.7	2.2
1975	99.0	101.6	97.4	102.0	100.0	100.6	99.5	99.9	100.8	99.9	100.0	99.5	1.2
1976	101.0	100.1	100.8	99.4	98.7	100.1	101.2	99.3	100.1	100.0	100.2	99.7	0.7
1977	98.8	100.4	100.8	100.0	100.3	100.3	100.0	99.1	101.7	98.2	99.9	100.9	0.9
S.D.	1.2	0.8	1.4	2.5	1.8	1.5	1.2	1.0	1.6	1.4	0.8	1.3	

TABLE TOTAL- 12002.9 MEAN- 100.0 STD. DEVIATION- 1.4

FINANCE,CHECKS CASHED IN CLEARING CENTERS-BY ACC.PERSONAL CHECKS

E 4. RATIOS OF ANNUAL TOTALS, ORIGINAL AND ADJUSTED SERIES

YEAR	UNMODIFIED	MODIFIED
1967	100.16	100.16
1968	100.53	100.52
1969	100.19	100.25
1970	100.06	100.08
1971	100.04	100.04
1972	100.19	100.07
1973	100.20	100.18
1974	100.11	100.11
1975	100.12	100.16
1976	100.23	100.27
1977	99.95	99.92
1978	99.95	99.95

E 5. MONTH-TO- MONTH CHANGES IN THE ORIGINAL SERIES

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	AVGE
1968	**********	-2.0	6.7	11.1	16.8	-10.3	9.4	-5.1	9.4	5.7	11.7	5.1	5.3
1969	-10.9	5.3	0.0	7.5	14.2	-1.9	-3.4	-9.0	7.9	5.1	3.4	1.9	1.7
1970	-5.1	-10.1	10.0	4.6	5.5	1.1	4.5	-9.2	13.0	-3.6	8.7	-0.4	1.6
1971	-11.6	0.6	15.2	-6.4	8.9	5.1	-2.6	-4.8	6.5	-3.7	14.5	-0.8	1.7
1972	-0.9	0.6	11.1	0.5	15.1	-1.7	-3.9	7.2	-6.1	12.2	24.0	-25.7	2.7
1973	6.8	-9.2	11.2	0.8	25.8	-1.5	-5.3	2.1	-6.4	13.0	0.9	-7.5	2.6
1974	5.5	-4.4	8.4	18.8	11.6	-11.2	2.0	-4.4	0.7	2.8	7.6	-5.3	2.7
1975	-2.7	-3.6	-0.2	13.1	0.0	6.4	-0.4	-6.9	9.3	-0.1	-4.5	9.0	1.6
1976	-6.4	0.7	8.4	-2.9	9.1	6.1	-5.4	-2.1	8.1	-1.6	4.6	-5.7	1.1
1977	-9.7	3.0	11.2	-9.2	23.3	2.1	-10.0	2.1	3.8	-8.1	16.7	-7.1	1.5
AVGE	-3.9	-1.9	8.2	3.8	13.0	-0.6	-1.5	-3.0	4.6	2.2	8.8	-3.7	

TABLE TOTAL- 264.4 MEAN- 2.2 STD. DEVIATION- 8.5

E 6. MONTH-TO- MONTH CHANGES IN THE FINAL SEASONALLY ADJUSTED SERIES (D11.)

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	AVGE
1968	**********	4.0	6.0	5.7	2.7	1.6	4.5	4.8	4.7	2.0	7.3	9.2	4.8
1969	-7.4	15.2	-5.7	2.2	6.6	2.9	-4.8	1.9	-0.1	3.4	1.0	1.0	1.3
1970	5.8	-5.3	1.2	1.8	0.5	1.4	5.2	-0.0	5.3	-0.7	0.4	2.6	1.5
1971	-1.0	4.3	1.9	-3.4	0.3	4.6	3.6	-2.1	2.4	0.7	2.8	4.9	1.6
1972	8.8	1.1	3.4	5.9	-3.5	5.5	1.1	5.5	-1.7	8.5	14.0	-15.1	2.8
1973	3.8	-0.2	4.5	-1.8	9.4	7.0	-3.9	2.4	-0.8	4.7	-1.7	2.3	2.1
1974	4.4	3.3	4.7	11.1	-1.1	-2.9	-0.8	3.3	-0.8	-0.2	6.2	0.2	2.3
1975	-1.0	2.7	-4.1	5.5	-6.7	8.3	0.6	2.1	2.7	0.6	-5.4	9.4	1.2
1976	3.5	0.1	0.8	-1.4	0.0	3.2	3.2	0.1	2.1	8.0	-6.9	-0.2	1.1
1977	-0.1	3.1	2.3	-5.8	8.5	0.6	0.1	-0.6	3.4	-2.0	3.7	3.3	1.4
AVGE	1.9	2.8	1.5	2.0	1.7	3.2	0.9	1.7	1.7	2.5	2.1	1.8	

TABLE TOTAL- 235.9 MEAN- 2.0 STD. DEVIATION- 4.4

FINANCE,CHECKS CASHED IN CLEARING CENTERS-BY ACC.PERSONAL CHECKS

F 1. MCD MOVING AVERAGE
MCD IS 2

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
1968	**********	481.	507.	533.	549.	563.	585.	613.	637.	663.	706.	736.	6573.
1969	751.	779.	787.	796.	833.	848.	837.	834.	844.	860.	874.	893.	9936.
1970	909.	900.	896.	908.	918.	937.	965.	990.	1014.	1024.	1031.	1042.	11533.
1971	1054.	1079.	1091.	1079.	1083.	1118.	1145.	1149.	1159.	1178.	1212.	1278.	13626.
1972	1352.	1398.	1447.	1488.	1502.	1533.	1583.	1623.	1665.	1789.	1871.	1797.	19048.
1973	1752.	1786.	1816.	1862.	1973.	2064.	2069.	2068.	2096.	2132.	2150.	2190.	23959.
1974	2270.	2359.	2500.	2657.	2690.	2639.	2631.	2663.	2672.	2705.	2788.	2825.	31398.
1975	2832.	2834.	2832.	2829.	2825.	2894.	2975.	3031.	3092.	3080.	3070.	3196.	35490.
1976	3324.	3362.	3364.	3347.	3362.	3445.	3529.	3577.	3688.	3784.	3719.	3645.	42145.
1977	3669.	3745.	3760.	3747.	3851.	3942.	3945.	3968.	4007.	4036.	4122.	********	42794.
AVGE	1990.	1872.	1900.	1924.	1959.	1998.	2026.	2052.	2087.	2125.	2154.	1956.	

TABLE TOTAL- 236501. MEAN- 2004. STD. DEVIATION- 1113.

F 2. SUMMARY MEASURES

F 2.A: AVERAGE PER CENT CHANGE WITHOUT REGARD TO SIGN OVER THE INDICATED SPAN

SPAN IN MONTHS	B1 O	D11 CI	D13 I	D12 C	D10 S	A2 P	C18 TD	F1 MCD	E1 MOD.O	E2 MOD.CI	E3 MOD.I
1	6.94	3.66	2.86	1.89	4.70	0.0	3.73	2.19	6.61	2.62	1.79
2	8.69	5.02	2.70	3.80	6.23	0.0	3.14	4.12	8.41	4.31	1.68
3	10.11	6.61	2.44	5.72	7.25	0.0	1.53	5.91	10.02	5.99	1.49
4	11.73	8.20	2.51	7.67	6.91	0.0	3.64	7.71	11.30	7.81	1.48
5	11.94	10.13	2.71	9.64	6.14	0.0	2.67	9.61	11.57	9.74	1.59
6	12.93	12.05	2.47	11.66	4.59	0.0	1.93	11.62	12.69	11.74	1.57
7	15.49	13.82	2.30	13.71	6.06	0.0	3.65	13.61	15.41	13.75	1.40
8	17.82	15.92	2.83	15.79	6.74	0.0	2.48	15.64	17.67	15.84	1.80
9	19.71	17.95	2.66	17.89	7.23	0.0	1.62	17.71	19.57	17.93	1.51
10	21.56	20.10	2.58	20.01	6.39	0.0	3.86	19.77	21.23	20.08	1.62
11	22.74	22.22	2.51	22.12	4.63	0.0	2.35	21.83	22.66	22.19	1.57
12	24.31	24.28	2.85	24.24	0.36	0.0	2.15	23.93	24.28	24.31	1.72

F 2.B: RELATIVE CONTRIBUTIONS TO THE VARIANCE OF THE PER CENT CHANGE IN THE COMPONENTS OF THE ORIGINAL SERIES

SPAN IN MONTHS	D13 I	D12 C	D10 S	A2 P	C18 TD	TOTAL	RATIO (X100)
1	17.10	7.51	46.27	0.0	29.12	100.00	99.18
2	10.32	20.54	55.11	0.0	14.03	100.00	93.23
3	6.37	34.96	56.17	0.0	2.50	100.00	91.59
4	5.00	46.61	37.86	0.0	10.52	100.00	91.70
5	5.07	64.04	25.99	0.0	4.89	100.00	101.82
6	3.67	81.48	12.62	0.0	2.23	100.00	99.83
7	2.17	77.24	15.12	0.0	5.47	100.00	101.42
8	2.59	80.70	14.71	0.0	2.00	100.00	97.25
9	1.85	83.79	13.67	0.0	0.69	100.00	93.39
10	1.43	86.52	8.82	0.0	3.22	100.00	99.53
11	1.20	93.64	4.11	0.0	1.05	100.00	101.07
12	1.35	97.85	0.02	0.0	0.77	100.00	101.66

F 2.C: AVERAGE PER CENT CHANGE WITH REGARD TO SIGN AND STANDARD DEVIATION OVER INDICATED SPAN

SPAN IN	B1 O		D13 I		D12 C		D10 S		D11 CI		F1 MCD	
MONTHS	AVGE	S.D.	AVGE	S.D.	AVGE	S.D.	AVGE	S.D.	AVGE	S.D.	AVGE	S.D.
1	2.22	8.49	0.09	3.99	1.89	1.32	0.18	5.62	1.98	4.37	1.87	1.99
2	4.39	10.41	0.09	3.92	3.80	2.60	0.41	7.29	3.91	5.17	3.77	3.53
3	6.42	11.75	0.06	3.51	5.72	3.76	0.56	9.17	5.82	5.84	5.68	4.61
4	8.45	12.64	0.07	3.65	7.67	4.79	0.54	8.47	7.78	6.80	7.61	5.56
5	10.17	11.68	0.07	3.91	9.64	5.71	0.37	7.38	9.75	7.64	9.59	6.42
6	12.05	10.74	0.07	3.77	11.66	6.58	0.24	5.42	11.77	8.29	11.60	7.15
7	14.31	12.77	0.06	3.25	13.71	7.45	0.42	7.19	13.81	8.78	13.61	7.89
8	16.65	14.35	0.08	3.84	15.79	8.33	0.60	8.02	15.92	9.90	15.64	8.77
9	18.73	15.75	0.01	3.82	17.89	9.21	0.67	8.99	17.95	10.79	17.71	9.69
10	20.80	16.00	0.03	3.55	20.01	10.07	0.51	7.42	20.10	11.66	19.77	10.49
11	22.50	14.62	0.02	3.68	22.12	10.86	0.24	5.41	22.22	12.62	21.83	11.27
12	24.25	13.66	-0.03	4.06	24.24	11.53	0.00	0.43	24.28	13.35	23.93	12.01

F 2.D: AVERAGE DURATION OF RUN

CI	I	C	MCD
2.02	1.45	23.80	5.09

F 2.E: I/C RATIO FOR MONTHS SPAN

1	2	3	4	.5	6	7	8	9	10	11	12
1.51	0.71	0.43	0.33	0.28	0.21	0.17	0.18	0.15	0.13	0.11	0.12

MONTHS FOR CYCLICAL DOMINANCE: 2

F 2.F: RELATIVE CONTRIBUTION OF THE COMPONENTS TO THE STATIONARY PORTION OF THE VARIANCE IN THE ORIGINAL SERIES

I	C	S	P	TD	TOTAL
6.47	58.14	24.50	0.0	5.42	94.53

F 2.G: THE AUTOCORRELATION OF THE IRREGULARS FOR SPANS 1 TO 14

1	2	3	4	5	6	7	8	9	10	11	12	13	14
-0.21	-0.12	0.08	0.04	-0.12	-0.02	0.26	-0.04	-0.06	0.09	0.07	-0.20	0.01	0.13

F 2.H: THE FINAL I/C RATIO FROM TABLE D12: 0.81
THE FINAL I/S RATIO FROM TABLE D10: 4.29

F 2.I:

		STATISTIC	PROBABILITY LEVEL
F-TEST FOR STABLE SEASONALITY FROM TABLE B 1.	:	15.253	0.00%
F-TEST FOR THE TRADING DAY REGESSION IN TABLE C15.	:	1.609	15.13%
F-TEST FOR STABLE SEASONALITY FROM TABLE D 8.	:	26.112	0.00%
KRUSKAL-WALLIS CHI SQUARED TEST FOR STABLE SEASONALITY FROM TABLE D 8.	:	87.950	0.00%
F-TEST FOR MOVING SEASONALITY FROM TABLE D 8.	:	0.783	63.25%

FINANCE,CHECKS CASHED IN CLEARING CENTERS-BY ACC.PERSONAL CHECKS

F 3. MONITORING AND QUALITY ASSESSMENT STATISTICS

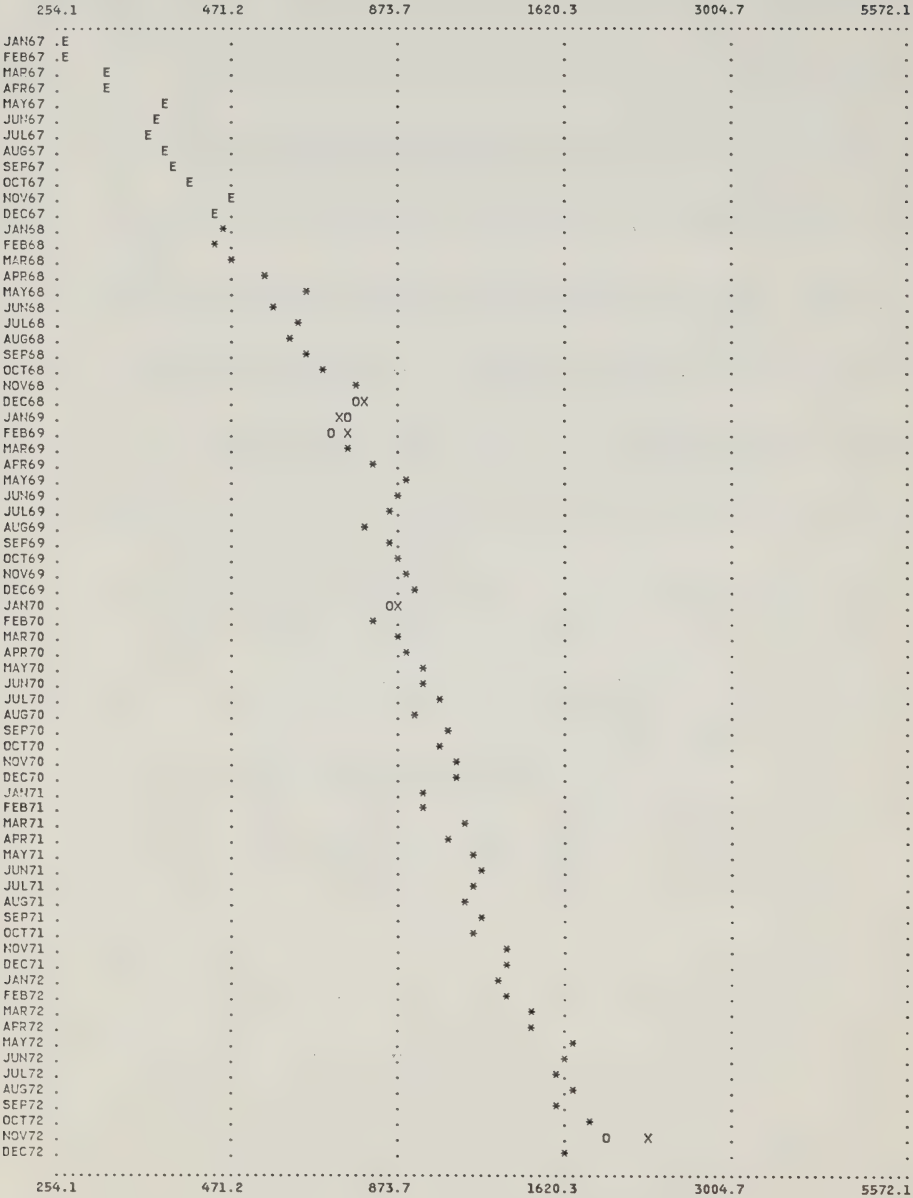
ALL THE MEASURES BELOW ARE IN THE RANGE FROM 0 TO 3 WITH AN ACCEPTANCE REGION FROM 0 TO 1.

1.	THE RELATIVE CONTRIBUTION OF THE IRREGULAR OVER THREE MONTHS SPAN (FROM TABLE F 2.B).	M1 = 0.637
2.	THE RELATIVE CONTRIBUTION OF THE IRREGULAR COMPONENT TO THE STATIONARY PORTION OF THE VARIANCE (FROM TABLE F 2.F).	M2 = 0.647
3.	THE AMOUNT OF MONTH TO MONTH CHANGE IN THE IRREGULAR COMPONENT AS COMPARED TO THE AMOUNT OF MONTH TO MONTH CHANGE IN THE TREND-CYCLE (FROM TABLE F2.H).	M3 = 0.0
4.	THE AMOUNT OF AUTOCORRELATION IN THE IRREGULAR AS DESCRIBED BY THE AVERAGE DURATION OF RUN (TABLE F 2.D).	M4 = 0.198
5.	THE NUMBER OF MONTHS IT TAKES THE CHANGE IN THE TREND-CYCLE TO SURPASS THE AMOUNT OF CHANGE IN THE IRREGULAR (FROM TABLE F 2.E).	M5 = 0.227
6.	THE AMOUNT OF YEAR TO YEAR CHANGE IN THE IRREGULAR AS COMPARED TO THE AMOUNT OF YEAR TO YEAR CHANGE IN THE SEASONAL (FROM TABLE F 2.H).	M6 = 0.116
7.	THE AMOUNT OF STABLE SEASONALITY PRESENT RELATIVE TO THE AMOUNT OF MOVING SEASONALITY (FROM TABLE F 2.I).	M7 = 0.423
8.	THE SIZE OF THE FLUCTUATIONS IN THE SEASONAL COMPONENT THROUGHOUT THE WHOLE SERIES.	M8 = 0.698
9.	THE AVERAGE LINEAR MOVEMENT IN THE SEASONAL COMPONENT THROUGHOUT THE WHOLE SERIES.	M9 = 0.484
10.	SAME AS 8, CALCULATED FOR RECENT YEARS ONLY.	M10 = 0.734
11.	SAME AS 9, CALCULATED FOR RECENT YEARS ONLY.	M11 = 0.708

*** ACCEPTED *** AT THE LEVEL 0.40

FINANCE,CHECKS CASHED IN CLEARING CENTERS-BY ACC.PERSONAL CHECKS

G 1. CHART
(X) - B 1. ORIGINAL SERIES
(O) - E 1. ORIGINAL SERIES MODIFIED FOR EXTREMES WITH ZERO FINAL WEIGHTS
(*) - COINCIDENCE OF POINTS
(E) - ARIMA EXTRAPOLATION
SCALE-SEMI-LOG



FINANCE,CHECKS CASHED IN CLEARING CENTERS-BY ACC.PERSONAL CHECKS

G 1. CHART

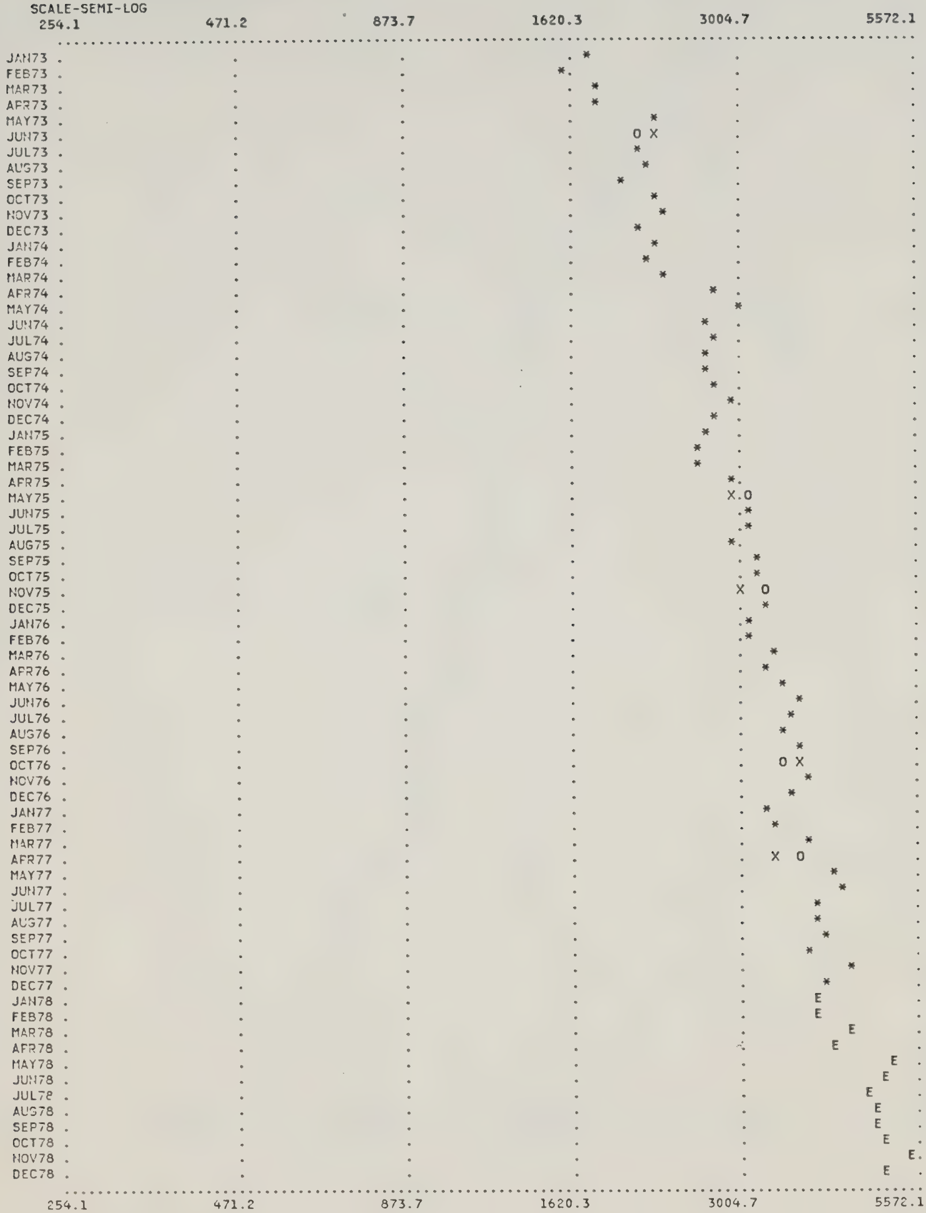
(X) - B 1. ORIGINAL SERIES

(O) - E 1. ORIGINAL SERIES MODIFIED FOR EXTREMES WITH ZERO FINAL WEIGHTS

(*) - COINCIDENCE OF POINTS

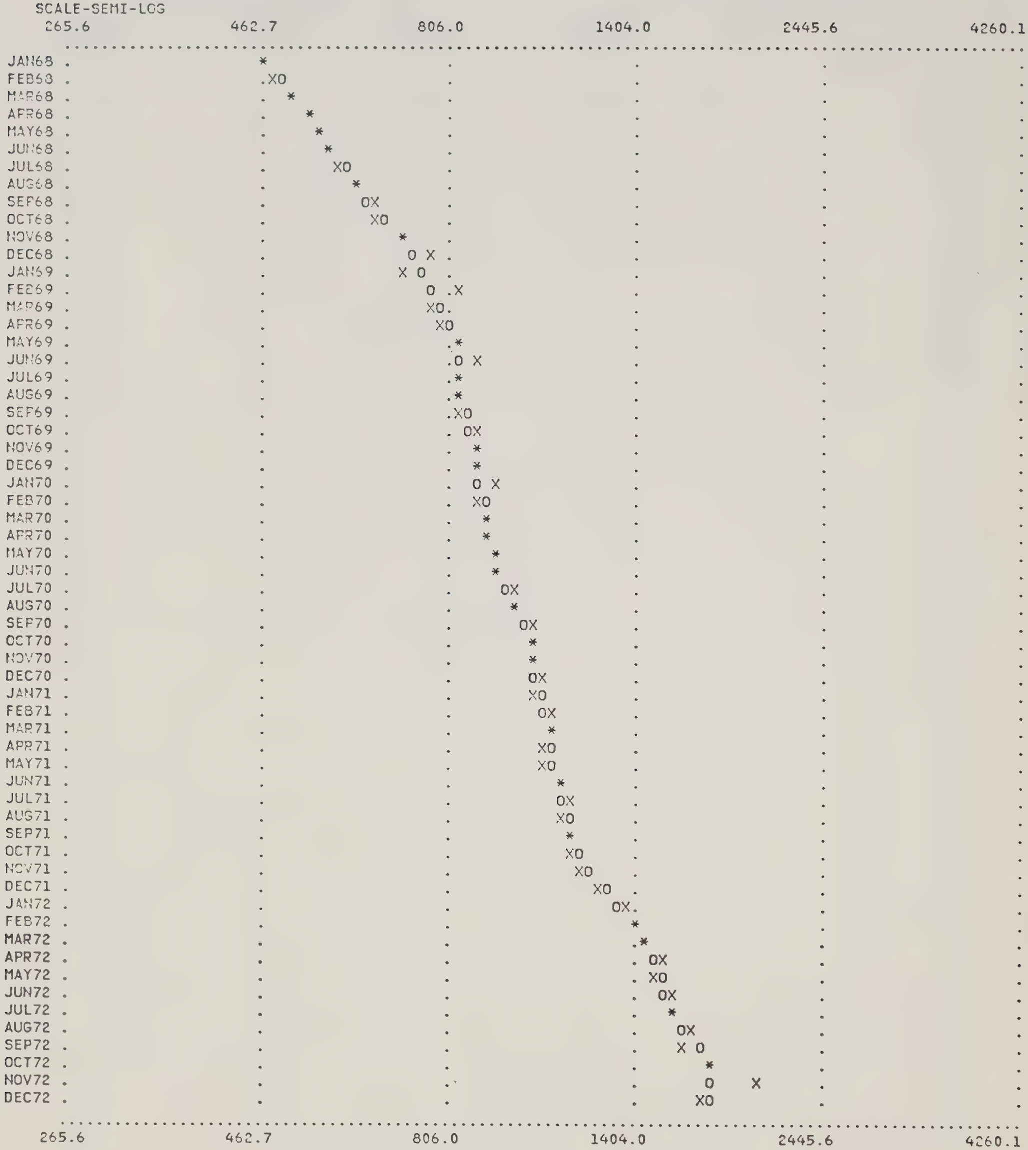
(E) - ARIMA EXTRAPOLATION

SCALE-SEMI-LOG



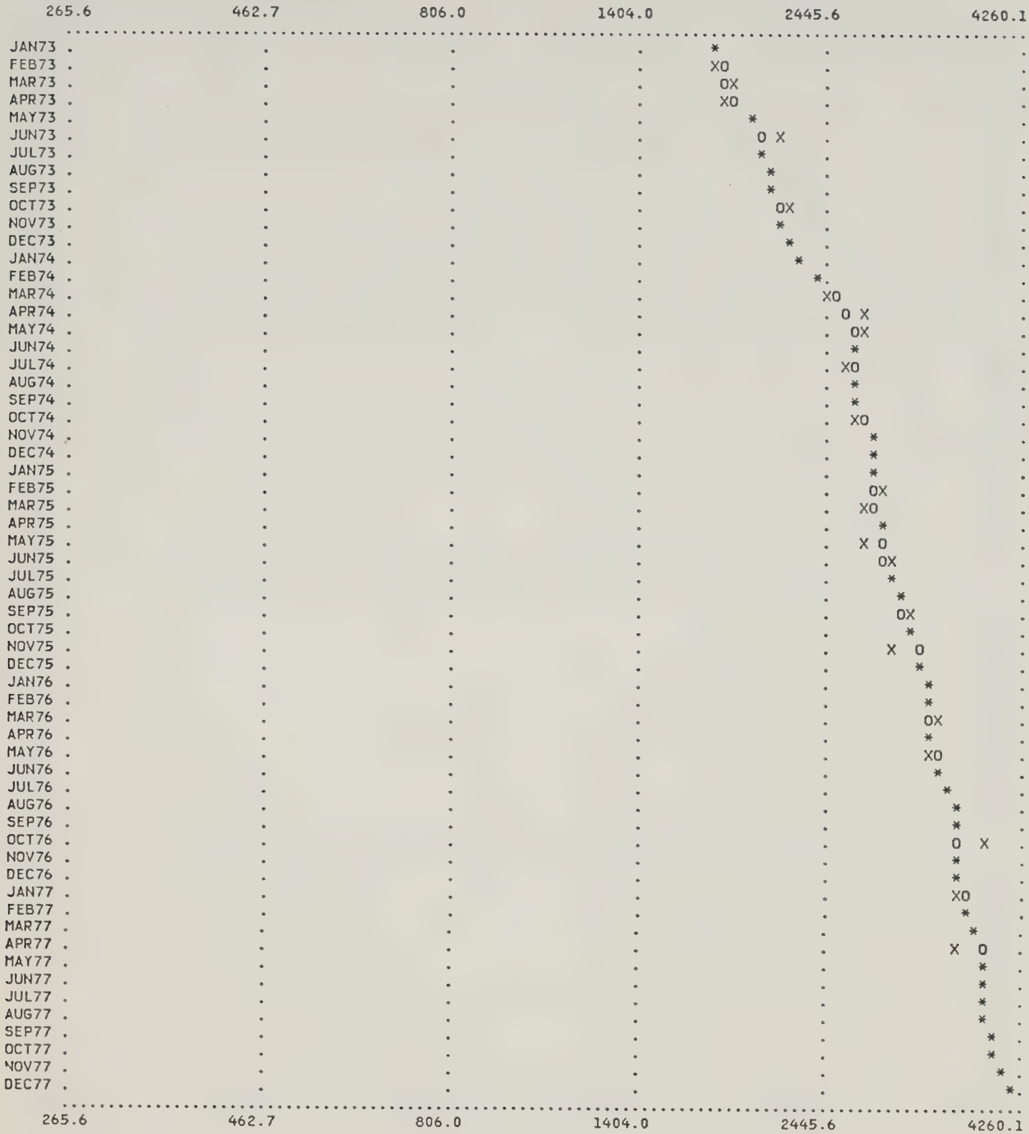
FINANCE,CHECKS CASHED IN CLEARING CENTERS-BY ACC.PERSONAL CHECKS

G 2. CHART
(X) - D11. FINAL SEASONALLY ADJUSTED SERIES
(O) - D12. FINAL TREND CYCLE
(*) - COINCIDENCE OF POINTS
SCALE-SEMI-LOG



FINANCE,CHECKS CASHED IN CLEARING CENTERS-BY ACC.PERSONAL CHECKS

G 2. CHART
(X) - D11. FINAL SEASONALLY ADJUSTED SERIES
(O) - D12. FINAL TREND CYCLE
(*) - COINCIDENCE OF POINTS
SCALE-SEMI-LOG



FINANCE,CHECKS CASHED IN CLEARING CENTERS-BY ACC.PERSONAL CHECKS

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G 3. CHART
        (X) - D10. FINAL SEASONAL FACTORS
        (O) - D 8. FINAL UNMODIFIED SI RATIOS
        (+) - D 9. FINAL RATIOS      MODIFIED FOR EXTREMES
        (*) - COINCIDENCE OF POINTS
        (E) - EXTRAPOLATED SEASONAL FACTORS
   SCALE-ARITHMETIC
       88.7                95.2               101.7               108.1                114.6               121.0
        .........................................................................................................
  JANUARY
   1968 .                    . X*                .                    .                   .                     .
   1969 .          O         .  X +              .                    .                   .                     .
   1970 .                    .  X+               O                    .                   .                     .
   1971 .                  * . X                 .                    .                   .                     .
   1972 .                    X       *           .                    .                   .                     .
   1973 .                 * X.                   .                    .                   .                     .
   1974 .                 *  .                   .                    .                   .                     .
   1975 .             *  X   .                   .                    .                   .                     .
   1976 .               X   *.                   .                    .                   .                     .
   1977 .           *  X     .                   .                    .                   .                     .
   1978 .              E     .                   .                    .                   .                     .
        .........................................................................................................
       88.7                95.2               101.7               108.1                114.6               121.0
        .........................................................................................................
  FEBRUARY
   1968 .    * X             .                   .                    .                   .                     .
   1969 .      X+            .      O            .                    .                   .                     .
   1970 .    *X              .                   .                    .                   .                     .
   1971 .    X   *           .                   .                    .                   .                     .
   1972 .  * X               .                   .                    .                   .                     .
   1973 .*   X               .                   .                    .                   .                     .
   1974 .   * X              .                   .                    .                   .                     .
   1975 .       X   *        .                   .                    .                   .                     .
   1976 .        X *         .                   .                    .                   .                     .
   1977 .          X*        .                   .                    .                   .                     .
   1978 .          E         .                   .                    .                   .                     .
        .........................................................................................................
       88.7                95.2               101.7               108.1                114.6               121.0
        .........................................................................................................
  MARCH
   1968 .                    .      X*           .                    .                   .                     .
   1969 .                    .   *   X           .                    .                   .                     .
   1970 .                    .       *           .                    .                   .                     .
   1971 .                    .       X      *    .                    .                   .                     .
   1972 .                    .    * X            .                    .                   .                     .
   1973 .                    .    X   *          .                    .                   .                     .
   1974 .                    .*  X               .                    .                   .                     .
   1975 .               *    .  X                .                    .                   .                     .
   1976 .                    .  X  *             .                    .                   .                     .
   1977 .                    .   X *             .                    .                   .                     .
   1978 .                    .   E               .                    .                   .                     .
        .........................................................................................................
       88.7                95.2               101.7               108.1                114.6               121.0
        .........................................................................................................
  APRIL
   1968 .                    .       X    *      .                    .                   .                     .
   1969 .                    .  *    X           .                    .                   .                     .
   1970 .                    .      X*           .                    .                   .                     .
   1971 .                    . *     X           .                    .                   .                     .
   1972 .                    .       X        *  .                    .                   .                     .
   1973 .                    .*       X          .                    .                   .                     .
   1974 .                    .        X    +     .         O          .                   .                     .
   1975 .                    .        X     *    .                    .                   .                     .
   1976 .                    .     * X           .                    .                   .                     .
   1977 .       O            .    + X            .                    .                   .                     .
   1978 .                    .     E             .                    .                   .                     .
        .........................................................................................................
       88.7                95.2               101.7               108.1                114.6               121.0
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FINANCE,CHECKS CASHED IN CLEARING CENTERS-BY ACC.PERSONAL CHECKS

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G 3. CHART
        (X) - D10. FINAL SEASONAL FACTORS
        (O) - D 8. FINAL UNMODIFIED SI RATIOS
        (+) - D 9. FINAL RATIOS      MODIFIED FOR EXTREMES
        (*) - COINCIDENCE OF POINTS
        (E) - EXTRAPOLATED SEASONAL FACTORS
   SCALE-ARITHMETIC
      88.7                95.2               101.7               108.1               114.6               121.0
       .....................................................................................................
MAY
  1968 .                    .                  .                   .     X *           .                   .
  1969 .                    .                  .                   .  X        *       .                   .
  1970 .                    .                  .                   * X                 .                   .
  1971 .                    .                  .            *      . X                 .                   .
  1972 .                    .                  .             *     .  X                .                   .
  1973 .                    .                  .                   .   X         *     .                   .
  1974 .                    .                  .                   .    X         *    .                   .
  1975 .                    .                  .    O              .+   X              .                   .
  1976 .                    .                  .                  *.   X               .                   .
  1977 .                    .                  .                   . X*                .                   .
  1978 .                    .                  .                   .E                  .                   .
       .....................................................................................................
      88.7                95.2               101.7               108.1               114.6               121.0
       .....................................................................................................
JUNE
  1968 .                    .                 *.  X                .                   .                   .
  1969 .                    .                  .   X +          O  .                   .                   .
  1970 .                    .                  .*    X             .                   .                   .
  1971 .                    .                  .       X*          .                   .                   .
  1972 .                    .                  .         X *       .                   .                   .
  1973 .                    .                  .           X+      .              O    .                   .
  1974 .                    .                  .           * X     .                   .                   .
  1975 .                    .                  .              X  * .                   .                   .
  1976 .                    .                  .               *X  .                   .                   .
  1977 .                    .                  .                X* .                   .                   .
  1978 .                    .                  .                 E .                   .                   .
       .....................................................................................................
      88.7                95.2               101.7               108.1               114.6               121.0
       .....................................................................................................
JULY
  1968 .                    .            *  X  .                   .                   .                   .
  1969 .                    .           *    X .                   .                   .                   .
  1970 .                    .                  X   *               .                   .                   .
  1971 .                    .                  .X       *          .                   .                   .
  1972 .                    .                  * X                 .                   .                   .
  1973 .                    .                  . *                 .                   .                   .
  1974 .                    .              *   .X                  .                   .                   .
  1975 .                    .                  *X                  .                   .                   .
  1976 .                    .                  . X   *             .                   .                   .
  1977 .                    .                  .  *                .                   .                   .
  1978 .                    .                  .  E                .                   .                   .
       .....................................................................................................
      88.7                95.2               101.7               108.1               114.6               121.0
       .....................................................................................................
AUGUST
  1968 .                    .*X                .                   .                   .                   .
  1969 .                    .  *               .                   .                   .                   .
  1970 .                    .*   X             .                   .                   .                   .
  1971 .                    .     * X          .                   .                   .                   .
  1972 .                    .         X    *   .                   .                   .                   .
  1973 .                    .           X *    .                   .                   .                   .
  1974 .                    .           X    * .                   .                   .                   .
  1975 .                    .          *       .                   .                   .                   .
  1976 .                    .       * X        .                   .                   .                   .
  1977 .                    .      * X         .                   .                   .                   .
  1978 .                    .       E          .                   .                   .                   .
       .....................................................................................................
      88.7                95.2               101.7               108.1               114.6               121.0
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FINANCE,CHECKS CASHED IN CLEARING CENTERS-BY ACC.PERSONAL CHECKS

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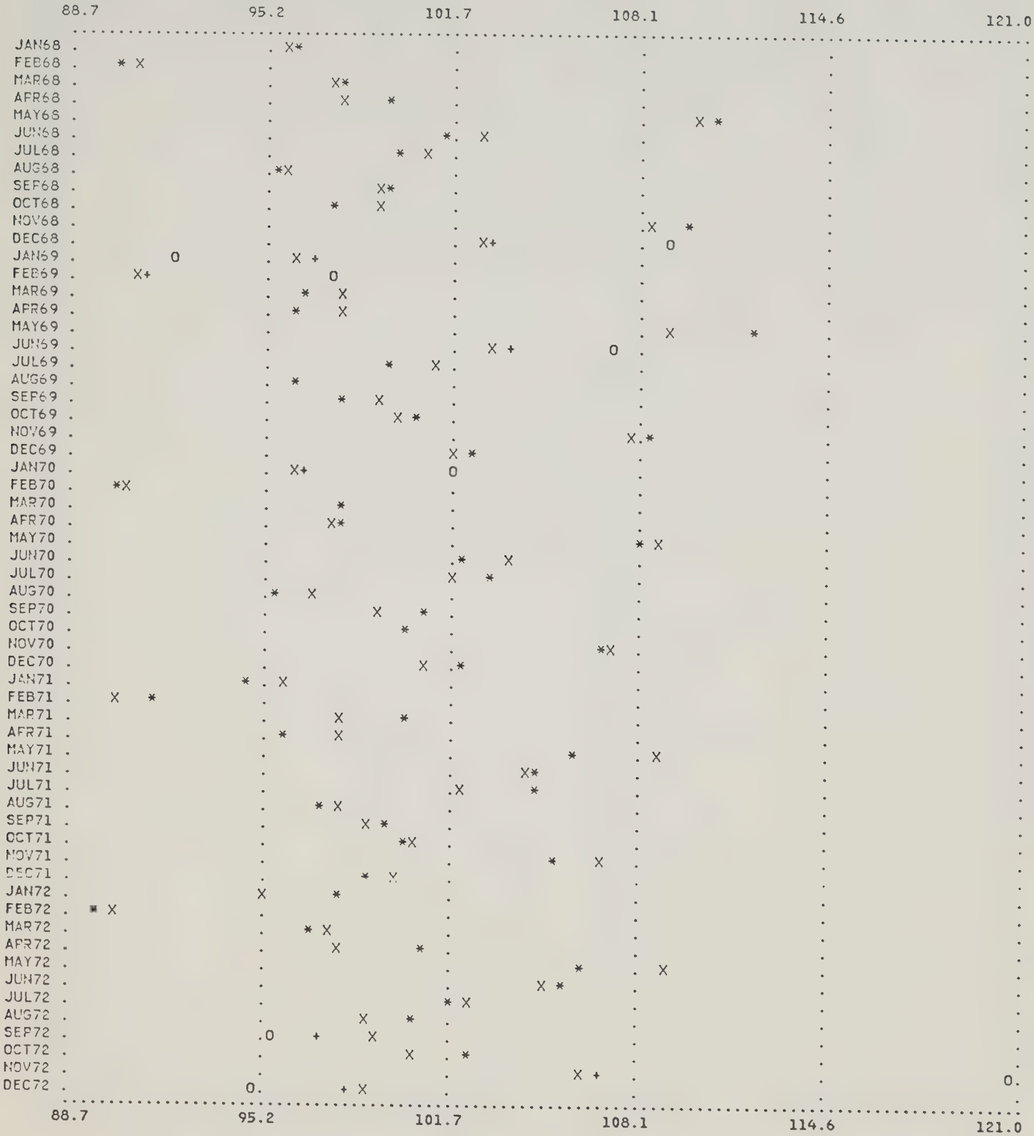
G 3. CHART
        (X) - D10. FINAL SEASONAL FACTORS
        (O) - D 8. FINAL UNMODIFIED SI RATIOS
        (+) - D 9. FINAL RATIOS      MODIFIED FOR EXTREMES
        (*) - COINCIDENCE OF POINTS
        (E) - EXTRAPOLATED SEASONAL FACTORS
   SCALE-ARITHMETIC
     88.7               95.2               101.7              108.1               114.6               121.0
      .....................................................................................................
SEPTEMBER
 1968 .                   .           X*      .                   .                   .                   .
 1969 .                   .       *   X       .                   .                   .                   .
 1970 .                   .           X    *  .                   .                   .                   .
 1971 .                   .          X *      .                   .                   .                   .
 1972 .                   .O    +     X       .                   .                   .                   .
 1973 .                   .       *   X       .                   .                   .                   .
 1974 .                   .            *X     .                   .                   .                   .
 1975 .                   .                X *.                   .                   .                   .
 1976 .                   .                  X*                   .                   .                   .
 1977 .                   .                   .X     *            .                   .                   .
 1978 .                   .                   . E                 .                   .                   .
      .....................................................................................................
     88.7               95.2               101.7              108.1               114.6               121.0
      .....................................................................................................
OCTOBER
 1968 .                   .      *    X       .                   .                   .                   .
 1969 .                   .             X *   .                   .                   .                   .
 1970 .                   .              *    .                   .                   .                   .
 1971 .                   .              *X   .                   .                   .                   .
 1972 .                   .               X   . *                 .                   .                   .
 1973 .                   .              X    .*                  .                   .                   .
 1974 .                   .     *      X      .                   .                   .                   .
 1975 .                   .         *X        .                   .                   .                   .
 1976 .                   .         X +       .            O      .                   .                   .
 1977 .                   .    *    X         .                   .                   .                   .
 1978 .                   .         E         .                   .                   .                   .
      .....................................................................................................
     88.7               95.2               101.7              108.1               114.6               121.0
      .....................................................................................................
NOVEMBER
 1968 .                   .                   .                   .X   *              .                   .
 1969 .                   .                   .                  X.*                  .                   .
 1970 .                   .                   .               *X  .                   .                   .
 1971 .                   .                   .          *    X   .                   .                   .
 1972 .                   .                   .             X +   .                   .                  O.
 1973 .                   .                   .        *    X     .                   .                   .
 1974 .                   .                   .           X      *.                   .                   .
 1975 .                   .         O         .         + X       .                   .                   .
 1976 .                   .                   .          X*       .                   .                   .
 1977 .                   .                   .         *X        .                   .                   .
 1978 .                   .                   .         E         .                   .                   .
      .....................................................................................................
     88.7               95.2               101.7              108.1               114.6               121.0
      .....................................................................................................
DECEMBER
 1968 .                   .                   .  X+               .  O                .                   .
 1969 .                   .                   X *                 .                   .                   .
 1970 .                   .                X  .*                  .                   .                   .
 1971 .                   .          *  X     .                   .                   .                   .
 1972 .                  O.         + X       .                   .                   .                   .
 1973 .                   .     *    X        .                   .                   .                   .
 1974 .                   .         X *       .                   .                   .                   .
 1975 .                   .         *X        .                   .                   .                   .
 1976 .                   .          *        .                   .                   .                   .
 1977 .                   .           X *     .                   .                   .                   .
 1978 .                   .           E       .                   .                   .                   .
      .....................................................................................................
     88.7               95.2               101.7              108.1               114.6               121.0
```

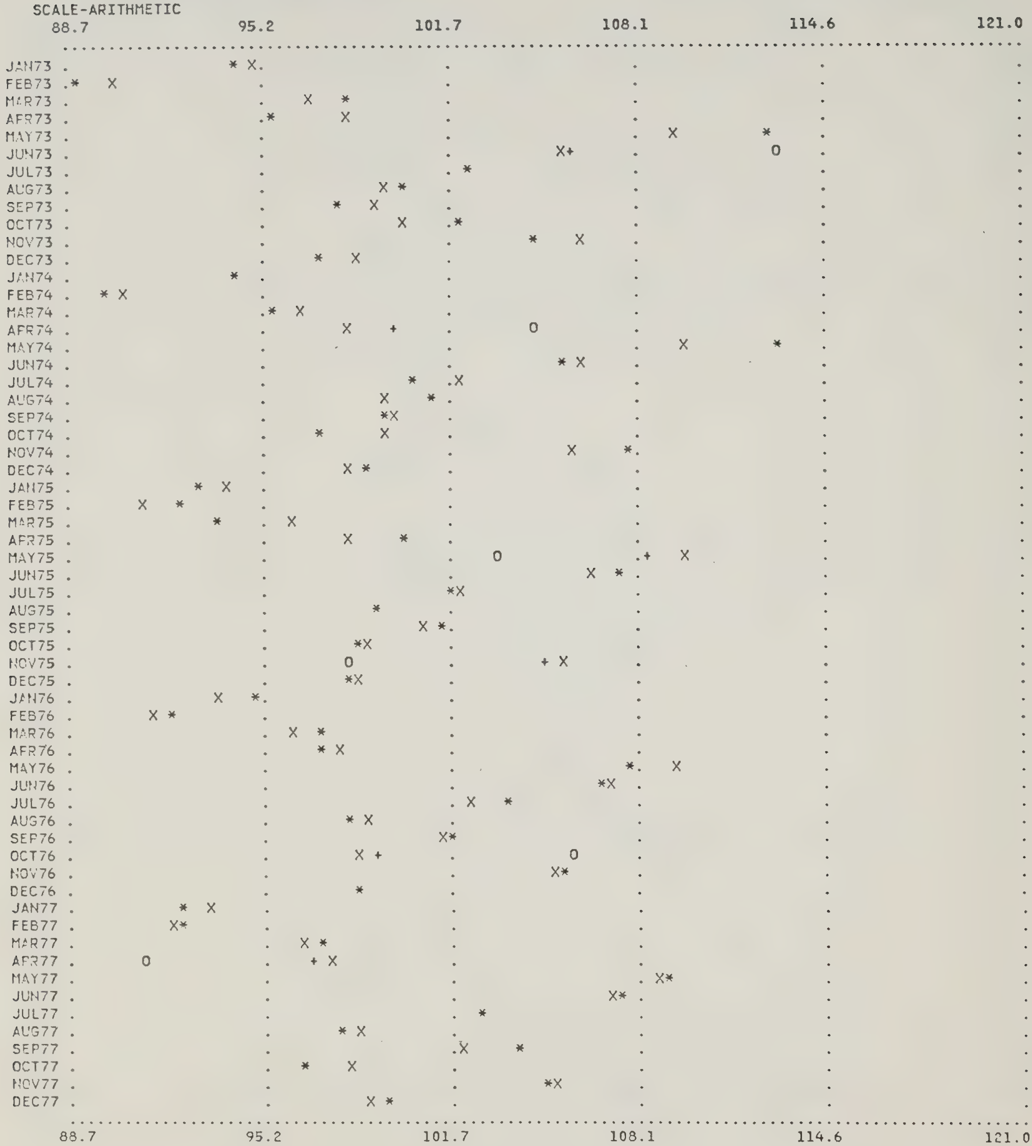
FINANCE,CHECKS CASHED IN CLEARING CENTERS-BY ACC.PERSONAL CHECKS

G 4. CHART
(X) - D10. FINAL SEASONAL FACTORS
(O) - D 8. FINAL UNMODIFIED SI RATIOS
(+) - D 9. FINAL RATIOS MODIFIED FOR EXTREMES
(*) - COINCIDENCE OF POINTS
(E) - EXTRAPOLATED SEASONAL FACTORS
SCALE-ARITHMETIC



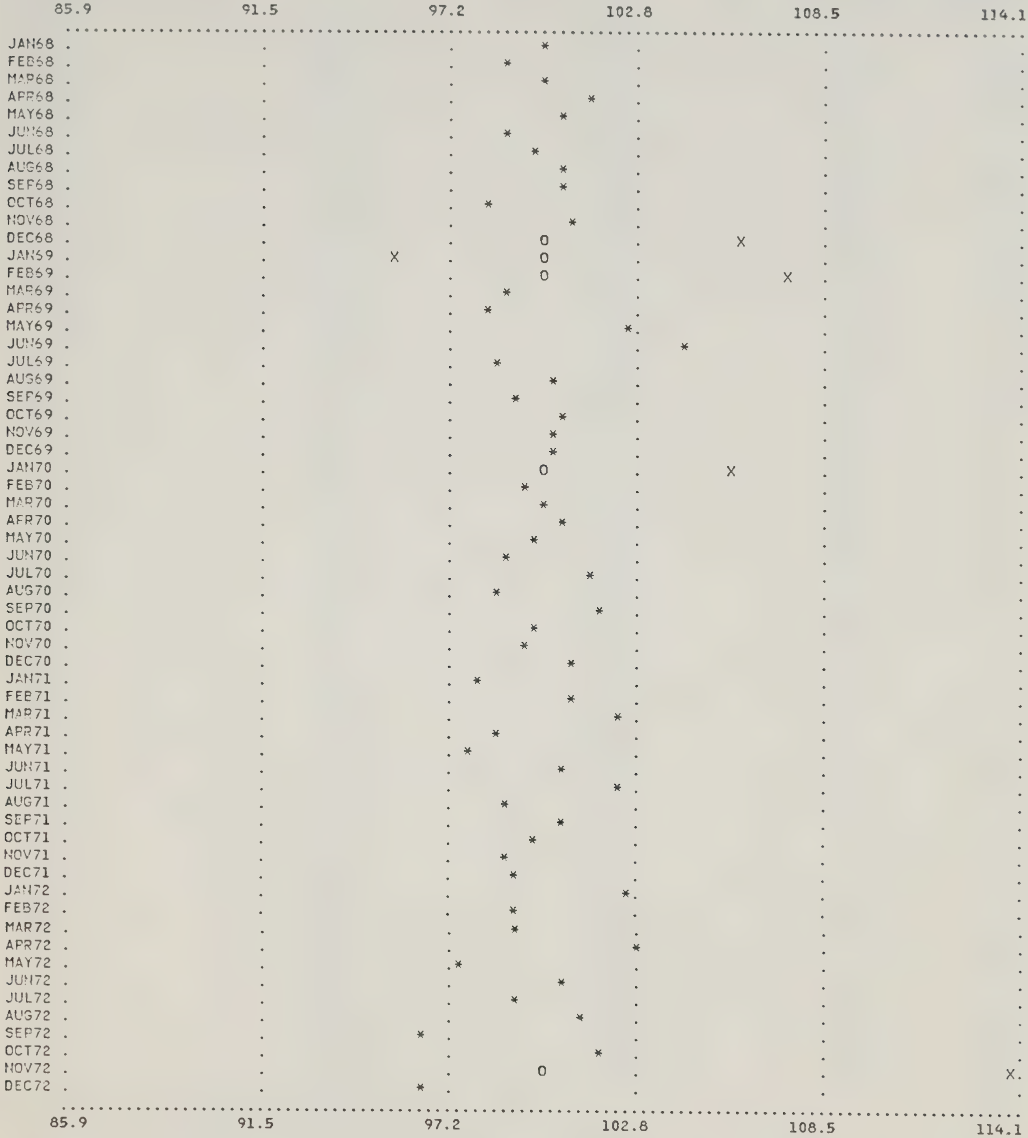
FINANCE,CHECKS CASHED IN CLEARING CENTERS-BY ACC.PERSONAL CHECKS

G 4. CHART
(X) - D10. FINAL SEASONAL FACTORS
(O) - D 8. FINAL UNMODIFIED SI RATIOS
(+) - D 9. FINAL RATIOS MODIFIED FOR EXTREMES
(*) - COINCIDENCE OF POINTS
(E) - EXTRAPOLATED SEASONAL FACTORS
SCALE-ARITHMETIC



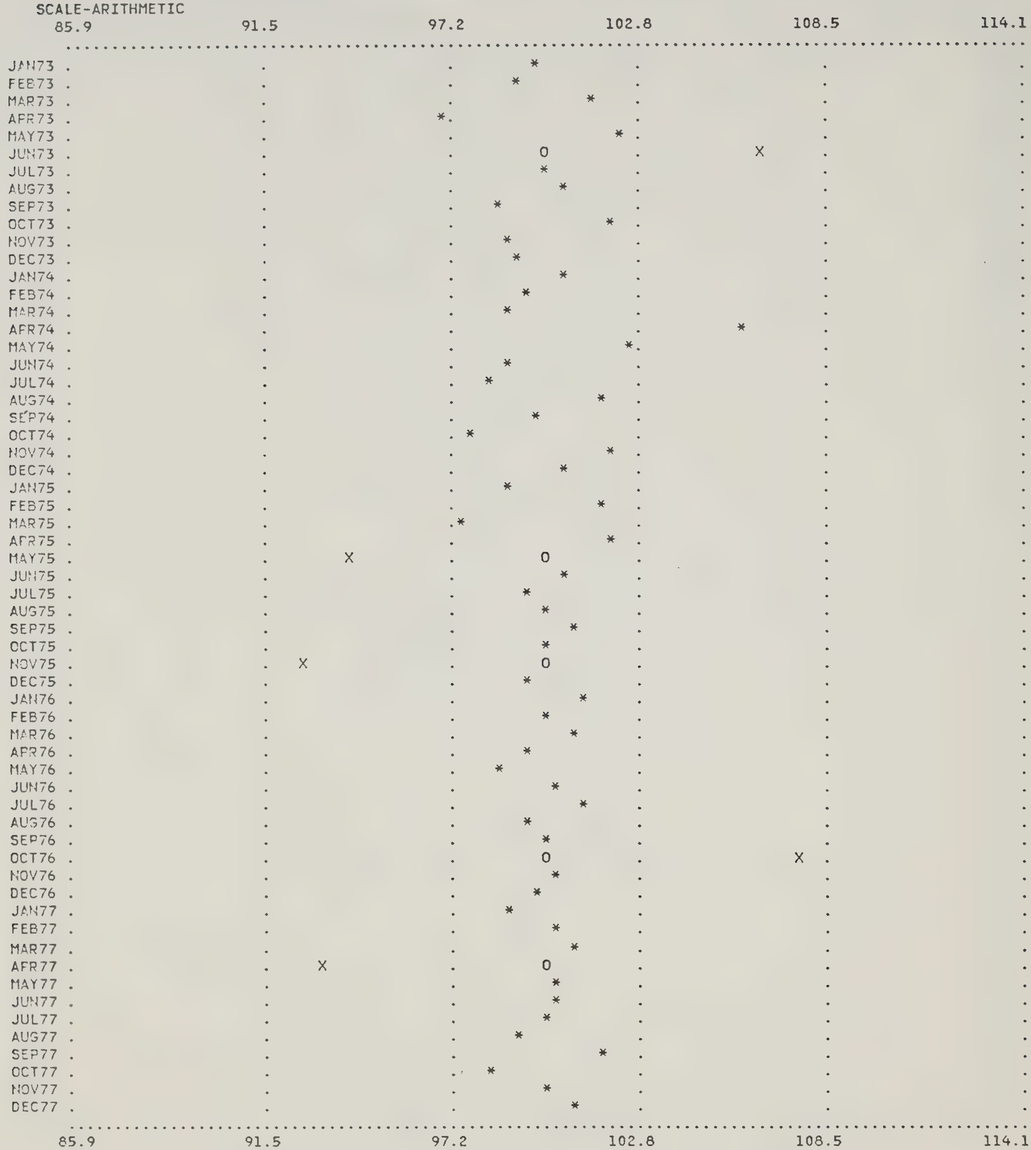
FINANCE,CHECKS CASHED IN CLEARING CENTERS-BY ACC.PERSONAL CHECKS

G 5. CHART
(X) - D13. FINAL IRREGULAR SERIES
(O) - E 3. FINAL MODIFIED IRREGULAR SERIES
(*) - COINCIDENCE OF POINTS
SCALE-ARITHMETIC



FINANCE,CHECKS CASHED IN CLEARING CENTERS-BY ACC.PERSONAL CHECKS

G 5. CHART
(X) - D13. FINAL IRREGULAR SERIES
(O) - E 3. FINAL MODIFIED IRREGULAR SERIES
(*) - COINCIDENCE OF POINTS
SCALE-ARITHMETIC



FINANCE,CHECKS CASHED IN CLEARING CENTERS-BY ACC.PERSONAL CHECKS

G 6. CHART

KOLMOGOROV-SMIRNOV SIGNIFICANCE TESTS FOR THE FINAL IRREGULARS

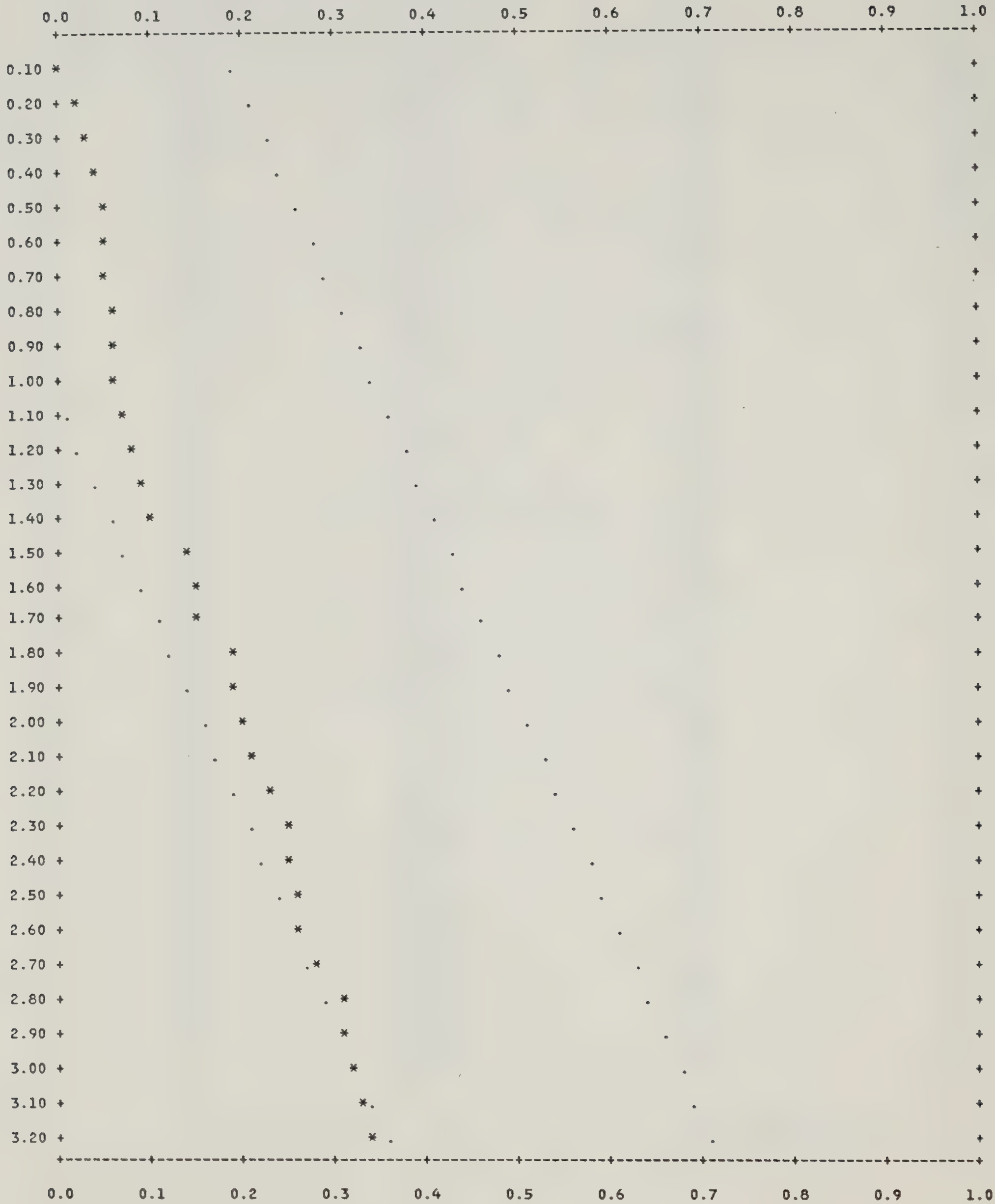
FREQUENCY IN CYC/YEAR	PERIOD IN YEARS	PERIODOGRAM	CUMULATIVE PERIODOGRAM	CONFIDENCE LEVELS
0.100000	10.0000	3.7067	0.0048	
0.200000	5.0000	11.5339	0.0199	
0.300000	3.3333	11.2436	0.0346	
0.400000	2.5000	5.2060	0.0415	
0.500000	2.0000	6.7847	0.0503	
0.600000	1.6667	2.3781	0.0534	
0.700000	1.4286	0.0589	0.0535	
0.800000	1.2500	4.6938	0.0597	
0.900000	1.1111	2.5488	0.0630	
1.000000	1.0000	0.8872	0.0642	
1.099999	0.9091	1.8040	0.0665	
1.199999	0.8333	6.6213	0.0752	
1.299999	0.7692	7.9886	0.0856	
1.399999	0.7143	11.4398	0.1006	
1.500000	0.6667	29.3208	0.1389	
1.599999	0.6250	4.6826	0.1451	
1.700000	0.5882	0.7211	0.1460	*
1.799999	0.5556	36.5937	0.1939	
1.900000	0.5263	0.2384	0.1942	
1.999999	0.5000	1.1368	0.1957	*
2.099999	0.4762	14.3193	0.2144	*
2.199999	0.4545	11.4629	0.2294	*
2.299999	0.4348	16.4464	0.2509	
2.400000	0.4167	1.2102	0.2525	*
2.499999	0.4000	6.2390	0.2607	*
2.599999	0.3846	1.2638	0.2623	*
2.699999	0.3704	13.0166	0.2793	*
2.799999	0.3571	20.7415	0.3065	*
2.899999	0.3448	6.2886	0.3147	*
3.000000	0.3333	7.1067	0.3240	*
3.099999	0.3226	3.4656	0.3285	**
3.200000	0.3125	8.8868	0.3402	**
3.299999	0.3030	32.6767	0.3829	*
3.400000	0.2941	10.3750	0.3965	*
3.499999	0.2857	105.8532	0.5349	
3.599999	0.2778	13.1979	0.5522	
3.699999	0.2703	0.3728	0.5527	
3.799999	0.2632	46.3633	0.6133	
3.900000	0.2564	0.3273	0.6138	
3.999999	0.2500	0.4336	0.6143	
4.099999	0.2439	15.0204	0.6340	
4.199999	0.2381	18.4275	0.6581	
4.299999	0.2326	9.7019	0.6708	
4.399999	0.2273	12.2060	0.6867	
4.500000	0.2222	11.0362	0.7012	
4.599999	0.2174	24.5260	0.7333	
4.700000	0.2128	7.6059	0.7432	
4.799999	0.2083	13.5316	0.7609	
4.900000	0.2041	19.7767	0.7868	
4.999999	0.2000	5.2074	0.7936	
5.099999	0.1961	26.2701	0.8280	
5.199999	0.1923	2.3301	0.8310	
5.299999	0.1887	28.6783	0.8685	
5.400000	0.1852	36.6396	0.9164	
5.499999	0.1818	6.3839	0.9248	
5.599999	0.1786	15.2612	0.9448	
5.699999	0.1754	7.7755	0.9549	
5.799999	0.1724	6.3370	0.9632	
5.899999	0.1695	18.4668	0.9874	
6.000000	0.1667	9.4387	0.9997	

CONFIDENCE LEVELS (   )-0% TO 75% LEVEL
(*)-75% TO 95% LEVEL
(**)- OVER 95% LEVEL

95% LEVEL= 0.1771   75% LEVEL= 0.1328

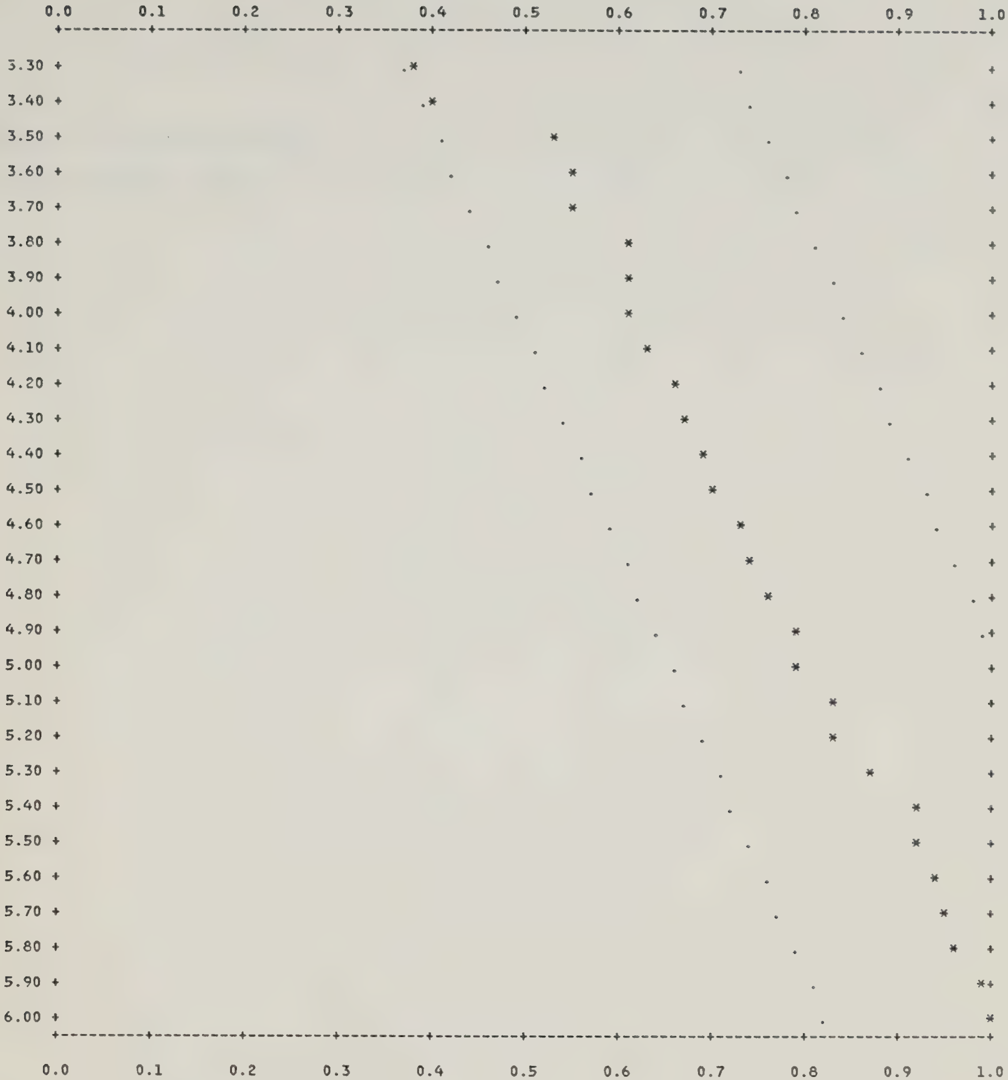
KOLMOGOROV-SMIRNOV SIGNIFICANCE TESTS FOR THE FINAL IRREGULARS

GRAPH OF THE CUMULATIVE PERIODOGRAM
(.) REPRESENTS 95% CONFIDENCE LIMITS
(*) REPRESENTS CUMULATIVE PERIODOGRAM



KOLMOGOROV-SMIRNOV SIGNIFICANCE TESTS FOR THE FINAL IRREGULARS

GRAPH OF THE CUMULATIVE PERIODOGRAM
(.) REPRESENTS 95% CONFIDENCE LIMITS
(*) REPRESENTS CUMULATIVE PERIODOGRAM



Freight and Shipping Payments –
Quarterly Analysis Printout

STATISTICS CANADA

X-11 ARIMA QUARTERLY SEASONAL ADJUSTMENT METHOD

THIS METHOD MODIFIES THE X-11 VARIANT OF CENSUS METHOD II
BY J. SHISKIN, A.H. YOUNG AND J.C. MUSGRAVE OF FEBRUARY, 1967.
THE MODIFICATIONS MADE ARE BASED ON THE METHODOLOGICAL RESEARCH
DEVELOPED BY ESTELA BEE DAGUM, CHIEF OF THE SEASONAL ADJUSTMENT
AND TIME SERIES STAFF OF STATISTICS CANADA. SEPTEMBER, 1979.

SERIES TITLE- FREIGHT AND SHIPPING PAYMENTS SERIES NO. FINALQ

-PERIOD COVERED- 1ST QUARTER,1969 TO 4TH QUARTER,1978
-TYPE OF RUN - ADDITIVE SEASONAL ADJUSTMENT
-ANALYSIS PRINTOUT. STANDARD CHARTS.
-SIGMA LIMITS FOR GRADUATING EXTREME VALUES ARE 1.5 AND 2.5 .
-ONE YEAR OF FORECASTS AND BACKCASTS FROM ARIMA MODEL SELECTED BY THE PROGRAM.

```
                                      1         2         3         4         5         6         7         8
COLUMN NUMBER              : 12345678901234567890123456789012345678901234567890123456789012345678901234567890

IMAGE OF THE MAIN OPTION CARD: Q3FINALQ  01690478   11  2       1
```

A 1. ORIGINAL SERIES

YEAR	1ST QUAR	2ND QUAR	3RD QUAR	4TH QUAR	TOTAL
1969	210.0	269.0	252.0	265.0	996.0
1970	232.0	306.0	284.0	284.0	1106.0
1971	212.0	324.0	343.0	317.0	1196.0
1972	247.0	350.0	350.0	368.0	1315.0
1973	322.0	411.0	399.0	428.0	1560.0
1974	427.0	545.0	499.0	565.0	2036.0
1975	467.0	586.0	525.0	569.0	2147.0
1976	479.0	618.0	547.0	575.0	2219.0
1977	490.0	641.0	606.0	609.0	2346.0
1978	528.8	687.8	641.6	669.1	2527.3
AVGE	361.5	473.8	444.7	464.9	

TABLE TOTAL- 17448.3 MEAN- 436.2 STD. DEVIATION- 143.5

AUTOREGRESSIVE INTEGRATED MOVING AVERAGE (ARIMA) EXTRAPOLATION PROGRAM

A5. ARIMA EXTRAPOLATION MODEL (FORECAST)

THIS PROGRAM WAS DEVELOPED FOLLOWING THE PROCEDURES OUTLINED IN
'TIME SERIES ANALYSIS' BY G. E. P. BOX AND G. M. JENKINS.

MODEL	TRAN.	ADDITIVE CONSTANT	AVERAGE PERCENTAGE STANDARD ERROR IN FORECASTS: LAST 3 YEARS	LAST YEAR	LAST-1 YEAR	LAST-2 YEAR	CHI-SQ. PROB.	R-SQUARED VALUE	ESTIMATED PARAMETERS
(0,1,1)(0,1,1)	NONE	0.0	3.02	2.05	2.90	4.12	48.37%	0.9570	0.2802E 00 0.3780E 00
(0,2,2)(0,1,1)	NONE	0.0	3.31	2.41	5.01	2.50	48.56%	0.9462	0.1076E 01-0.1778E 00 0.3019E 00

THE MODEL CHOSEN IS (0,1,1)(0,1,1)0 WITH TRANSFORMATION - NONE

AUTOREGRESSIVE INTEGRATED MOVING AVERAGE (ARIMA) EXTRAPOLATION PROGRAM

A6. ARIMA EXTRAPOLATION MODEL (BACKCAST)

THIS PROGRAM WAS DEVELOPED FOLLOWING THE PROCEDURES OUTLINED IN
'TIME SERIES ANALYSIS' BY G. E. P. BOX AND G. M. JENKINS.

MODEL	TRAN.	ADDITIVE CONSTANT	AVERAGE PERCENTAGE STANDARD ERROR IN BACKCASTS: LAST 3 YEARS	LAST YEAR	LAST-1 YEAR	LAST-2 YEAR	CHI-SQ. PROB.	R-SQUARED VALUE	ESTIMATED PARAMETERS
(0,1,1)(0,1,1)	NONE	0.0	11.92	8.46	11.66	15.63	46.72%	0.9562	0.2698E 00 0.4341E 00

THE MODEL CHOSEN IS (0,1,1)(0,1,1)0 WITH TRANSFORMATION - NONE

FREIGHT AND SHIPPING PAYMENTS

B 1. ORIGINAL SERIES

YEAR	1ST QUAR	2ND QUAR	3RD QUAR	4TH QUAR	TOTAL
1968	184.5	256.5	242.4	249.3	932.7
1969	210.0	269.0	252.0	265.0	996.0
1970	232.0	306.0	284.0	284.0	1106.0
1971	212.0	324.0	343.0	317.0	1196.0
1972	247.0	350.0	350.0	368.0	1315.0
1973	322.0	411.0	399.0	428.0	1560.0
1974	427.0	545.0	499.0	565.0	2036.0
1975	467.0	586.0	525.0	569.0	2147.0
1976	479.0	618.0	547.0	575.0	2219.0
1977	490.0	641.0	606.0	609.0	2346.0
1978	528.8	687.8	641.6	669.1	2527.3
AVGE	345.4	454.0	426.3	445.3	

TABLE TOTAL- 18381.0 MEAN- 417.7 STD. DEVIATION- 149.0

ORIGINAL SERIES EXTRAPOLATED ONE YEAR AHEAD

YEAR	1ST QUAR	2ND QUAR	3RD QUAR	4TH QUAR	TOTAL
1979	583.7	736.7	690.7	713.5	2724.7

D10. FINAL SEASONAL FACTORS
3X5 MOVING AVERAGE SELECTED.

YEAR	1ST QUAR	2ND QUAR	3RD QUAR	4TH QUAR	AVGE
1969	-46.2	28.0	9.9	8.9	0.2
1970	-48.1	29.1	10.7	8.9	0.1
1971	-50.0	31.0	10.0	10.0	0.2
1972	-52.9	34.4	7.7	11.8	0.3
1973	-56.4	39.5	3.7	14.5	0.3
1974	-60.5	45.2	0.0	16.5	0.3
1975	-64.9	51.0	-2.9	18.5	0.4
1976	-70.1	55.9	-3.5	19.3	0.4
1977	-74.7	59.4	-2.8	18.9	0.2
1978	-77.4	61.0	-1.2	17.6	0.0
AVGE	-60.1	43.4	3.2	14.5	

TABLE TOTAL- 9.8 MEAN- 0.2 STD. DEVIATION- 38.8

D10A. SEASONAL FACTORS, ONE YEAR AHEAD

YEAR	1ST QUAR	2ND QUAR	3RD QUAR	4TH QUAR	AVGE
1979	-78.2	61.4	-0.3	16.8	-0.1

D11. FINAL SEASONALLY ADJUSTED SERIES

YEAR	1ST QUAR	2ND QUAR	3RD QUAR	4TH QUAR	TOTAL
1969	256.2	241.0	242.1	256.1	995.3
1970	280.1	276.9	273.3	275.1	1105.4
1971	262.0	293.0	333.0	307.0	1195.0
1972	299.9	315.6	342.3	356.2	1313.9
1973	378.4	371.5	395.3	413.5	1558.7
1974	487.5	499.8	499.0	548.5	2034.9
1975	531.9	535.0	527.9	550.5	2145.3
1976	549.1	562.1	550.5	555.7	2217.5
1977	564.7	581.6	608.8	590.1	2345.1
1978	606.2	626.8	642.8	651.5	2527.2
AVGE	421.6	430.3	441.5	450.4	

TABLE TOTAL- 17438.4 MEAN- 436.0 STD. DEVIATION- 136.4

FREIGHT AND SHIPPING PAYMENTS

E 5. QUARTER-TO-QUARTER CHANGES IN THE ORIGINAL SERIES

YEAR	1ST QUAR	2ND QUAR	3RD QUAR	4TH QUAR	AVGE
1969	***************	59.0	-17.0	13.0	18.3
1970	-33.0	74.0	-22.0	0.0	4.8
1971	-72.0	112.0	19.0	-26.0	8.3
1972	-70.0	103.0	0.0	18.0	12.8
1973	-46.0	89.0	-12.0	29.0	15.0
1974	-1.0	118.0	-46.0	66.0	34.3
1975	-98.0	119.0	-61.0	44.0	1.0
1976	-90.0	139.0	-71.0	28.0	1.5
1977	-85.0	151.0	-35.0	3.0	8.5
1978	-80.2	159.0	-46.2	27.5	15.0
AVGE	-63.9	112.3	-29.1	20.3	

TABLE TOTAL- 459.1 MEAN- 11.8 STD. DEVIATION- 71.6

FREIGHT AND SHIPPING PAYMENTS

E 6. QUARTER-TO-QUARTER CHANGES IN THE FINAL SEASONALLY ADJUSTED SERIES (D11.)

YEAR	1ST QUAR	2ND QUAR	3RD QUAR	4TH QUAR	AVGE
1969	***************	-15.2	1.1	14.0	-0.0
1970	24.1	-3.2	-3.7	1.9	4.8
1971	-13.1	31.0	40.0	-26.0	8.0
1972	-7.2	15.7	26.7	14.0	12.3
1973	22.2	-6.9	23.8	18.3	14.3
1974	74.0	12.3	-0.9	49.6	33.7
1975	-16.6	3.1	-7.2	22.6	0.5
1976	-1.4	13.0	-11.6	5.2	1.3
1977	9.0	16.9	27.3	-18.8	8.6
1978	16.2	20.6	16.0	8.7	15.4
AVGE	11.9	8.7	11.2	8.9	

TABLE TOTAL- 395.3 MEAN- 10.1 STD. DEVIATION- 19.5

FREIGHT AND SHIPPING PAYMENTS

F 2. SUMMARY MEASURES

F 2.A: AVERAGE DIFFERENCES WITHOUT REGARD TO SIGN OVER THE INDICATED SPAN

SPAN IN QUARTERS	B1 O	D11 CI	D13 I	D12 C	D10 S	A2 P	C18 TD	F1 QCD	E1 MOD.O	E2 MOD.CI	E3 MOD.I
1	58.51	16.89	10.97	11.92	57.43	0.0	0.0	16.89	58.40	14.90	9.04
2	51.99	25.91	7.66	22.91	47.10	0.0	0.0	25.91	49.95	24.62	5.61
3	73.35	35.08	9.51	32.73	58.36	0.0	0.0	35.08	73.35	34.14	7.78
4	43.65	43.56	8.60	42.84	2.61	0.0	0.0	43.56	43.65	43.56	6.68

F 2.B: RELATIVE CONTRIBUTIONS TO THE VARIANCE OF THE DIFFERENCES IN THE COMPONENTS OF THE ORIGINAL SERIES

SPAN IN QUARTERS	D13 I	D12 C	D10 S	A2 P	C18 TD	TOTAL	RATIO (X100)
1	3.38	3.99	92.63	0.0	0.0	100.00	103.99
2	2.09	18.74	79.17	0.0	0.0	100.00	103.68
3	1.98	23.45	74.57	0.0	0.0	100.00	84.90
4	3.86	95.78	0.35	0.0	0.0	100.00	100.59

F 2.C: AVERAGE DIFFERENCES WITH REGARD TO SIGN AND STANDARD DEVIATION OVER INDICATED SPAN

SPAN IN	B1 O		D13 I		D12 C		D10 S		D11 CI		F1 QCD	
QUARTERS	AVGE	S.D.	AVGE	S.D.	AVGE	S.D.	AVGE	S.D.	AVGE	S.D.	AVGE	S.D.
1	11.77	71.64	-0.27	13.81	10.40	11.38	1.64	69.32	10.14	19.50	10.14	19.50
2	21.89	57.68	-0.20	11.81	21.18	20.51	0.91	50.60	20.98	26.33	20.98	26.33
3	34.26	75.66	-0.18	11.76	32.12	26.74	2.32	69.30	31.94	30.21	31.94	30.21
4	42.54	33.57	-0.14	11.56	42.69	31.29	-0.02	3.06	42.56	33.29	42.56	33.29

F 2.D: AVERAGE DURATION OF RUN

CI	I	C	QCD
1.77	1.26	3.90	1.77

F 2.E: I/C RATIO FOR QUARTERS SPAN

1	2	3	4
0.92	0.33	0.29	0.20

QUARTERS FOR CYCLICAL DOMINANCE: 1

F 2.F: RELATIVE CONTRIBUTION OF THE COMPONENTS TO THE STATIONARY PORTION OF THE VARIANCE IN THE ORIGINAL SERIES

I	C	S	P	TD	TOTAL
2.89	32.77	66.79	0.0	0.0	102.45

F 2.G: THE AUTOCORRELATION OF THE IRREGULARS FOR SPANS 1 TO 6

1	2	3	4	5	6
-0.45	-0.04	0.00	0.06	-0.00	-0.04

F 2.H: THE FINAL I/C RATIO FROM TABLE D12: 0.66
THE FINAL I/S RATIO FROM TABLE D10: 2.08

F 2.I:

		STATISTIC	PROBABILITY LEVEL
F-TEST FOR STABLE SEASONALITY FROM TABLE B 1.	:	69.098	0.00%
F-TEST FOR STABLE SEASONALITY FROM TABLE D 8.	:	89.698	0.00%
KRUSKAL-WALLIS CHI SQUARED TEST FOR STABLE SEASONALITY FROM TABLE D 8.	:	31.234	0.00%
F-TEST FOR MOVING SEASONALITY FROM TABLE D 8.	:	3.035	1.22%

FREIGHT AND SHIPPING PAYMENTS

F 3. MONITORING AND QUALITY ASSESSMENT STATISTICS

ALL THE MEASURES BELOW ARE IN THE RANGE FROM 0 TO 3 WITH AN ACCEPTANCE REGION FROM 0 TO 1.

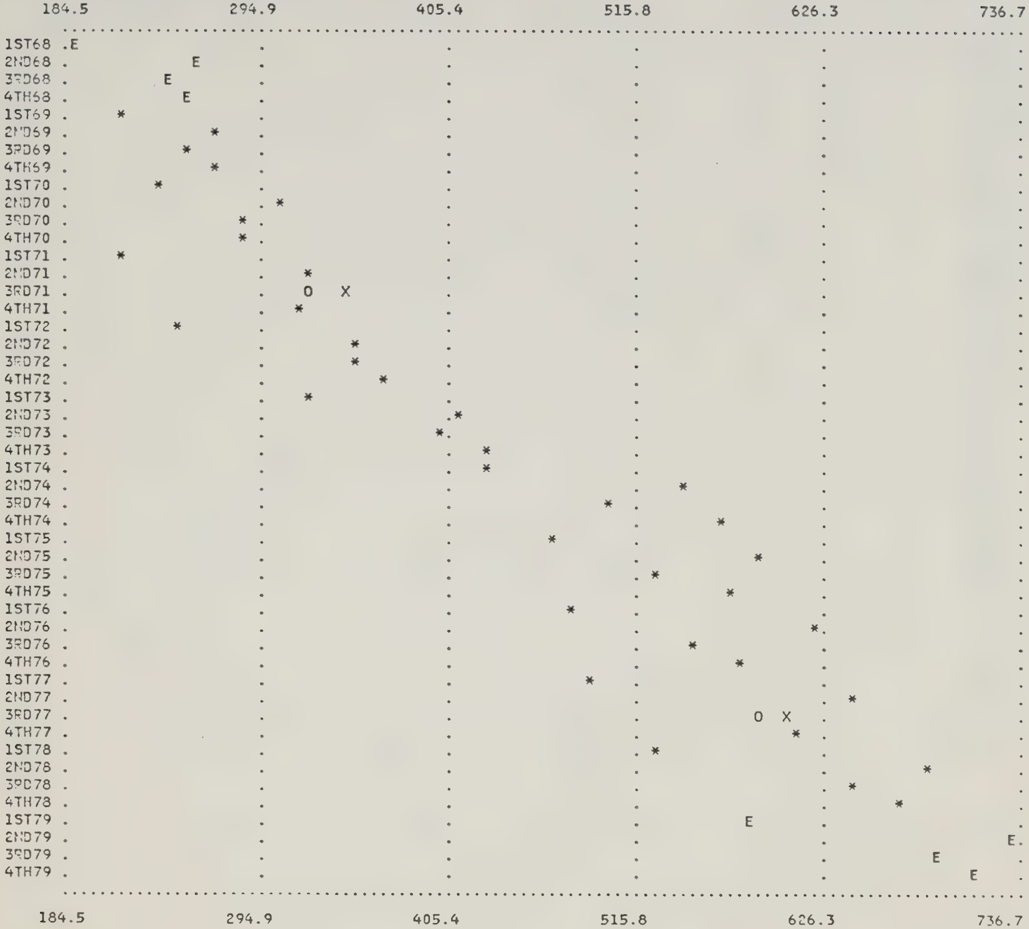
1.	THE RELATIVE CONTRIBUTION OF THE IRREGULAR OVER ONE QUARTER SPAN (FROM TABLE F 2.B).	M1 = 0.338
2.	THE RELATIVE CONTRIBUTION OF THE IRREGULAR COMPONENT TO THE STATIONARY PORTION OF THE VARIANCE (FROM TABLE F 2.F).	M2 = 0.289
3.	THE AMOUNT OF QUARTER TO QUARTER CHANGE IN THE IRREGULAR COMPONENT AS COMPARED TO THE AMOUNT OF QUARTER TO QUARTER CHANGE IN THE TREND-CYCLE (FROM TABLE F2.H).	M3 = 0.490
4.	THE AMOUNT OF AUTOCORRELATION IN THE IRREGULAR AS DESCRIBED BY THE AVERAGE DURATION OF RUN (TABLE F 2.D).	M4 = 0.695
5.	THE NUMBER OF QUARTERS IT TAKES THE CHANGE IN THE TREND-CYCLE TO SURPASS THE AMOUNT OF CHANGE IN THE IRREGULAR (FROM TABLE F 2.E).	M5 = 0.418
6.	THE AMOUNT OF YEAR TO YEAR CHANGE IN THE IRREGULAR AS COMPARED TO THE AMOUNT OF YEAR TO YEAR CHANGE IN THE SEASONAL (FROM TABLE F 2.H).	M6 = 0.766
7.	THE AMOUNT OF STABLE SEASONALITY PRESENT RELATIVE TO THE AMOUNT OF MOVING SEASONALITY (FROM TABLE F 2.I).	M7 = 0.300
8.	THE SIZE OF THE FLUCTUATIONS IN THE SEASONAL COMPONENT THROUGHOUT THE WHOLE SERIES.	M8 = 0.683
9.	THE AVERAGE LINEAR MOVEMENT IN THE SEASONAL COMPONENT THROUGHOUT THE WHOLE SERIES.	M9 = 0.642
10.	SAME AS 8, CALCULATED FOR RECENT YEARS ONLY.	M10 = 1.049
11.	SAME AS 9, CALCULATED FOR RECENT YEARS ONLY.	M11 = 1.049

*** ACCEPTED *** AT THE LEVEL 0.52

*** CHECK THE 2 ABOVE MEASURES WHICH FAILED.

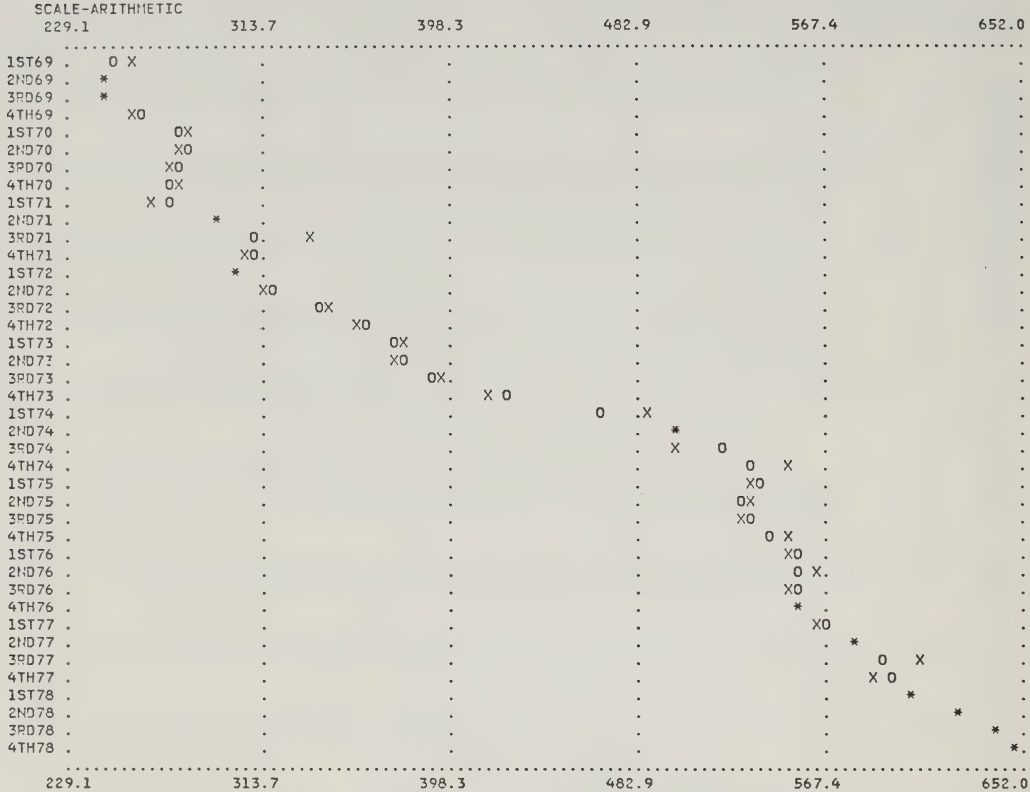
FREIGHT AND SHIPPING PAYMENTS

G 1. CHART
(X) - B 1. ORIGINAL SERIES
(O) - E 1. ORIGINAL SERIES MODIFIED FOR EXTREMES WITH ZERO FINAL WEIGHTS
(*) - COINCIDENCE OF POINTS
(E) - ARIMA EXTRAPOLATION
SCALE-ARITHMETIC



FREIGHT AND SHIPPING PAYMENTS

G 2. CHART
(X) - D11. FINAL SEASONALLY ADJUSTED SERIES
(O) - D12. FINAL TREND CYCLE
(*) - COINCIDENCE OF POINTS
SCALE-ARITHMETIC

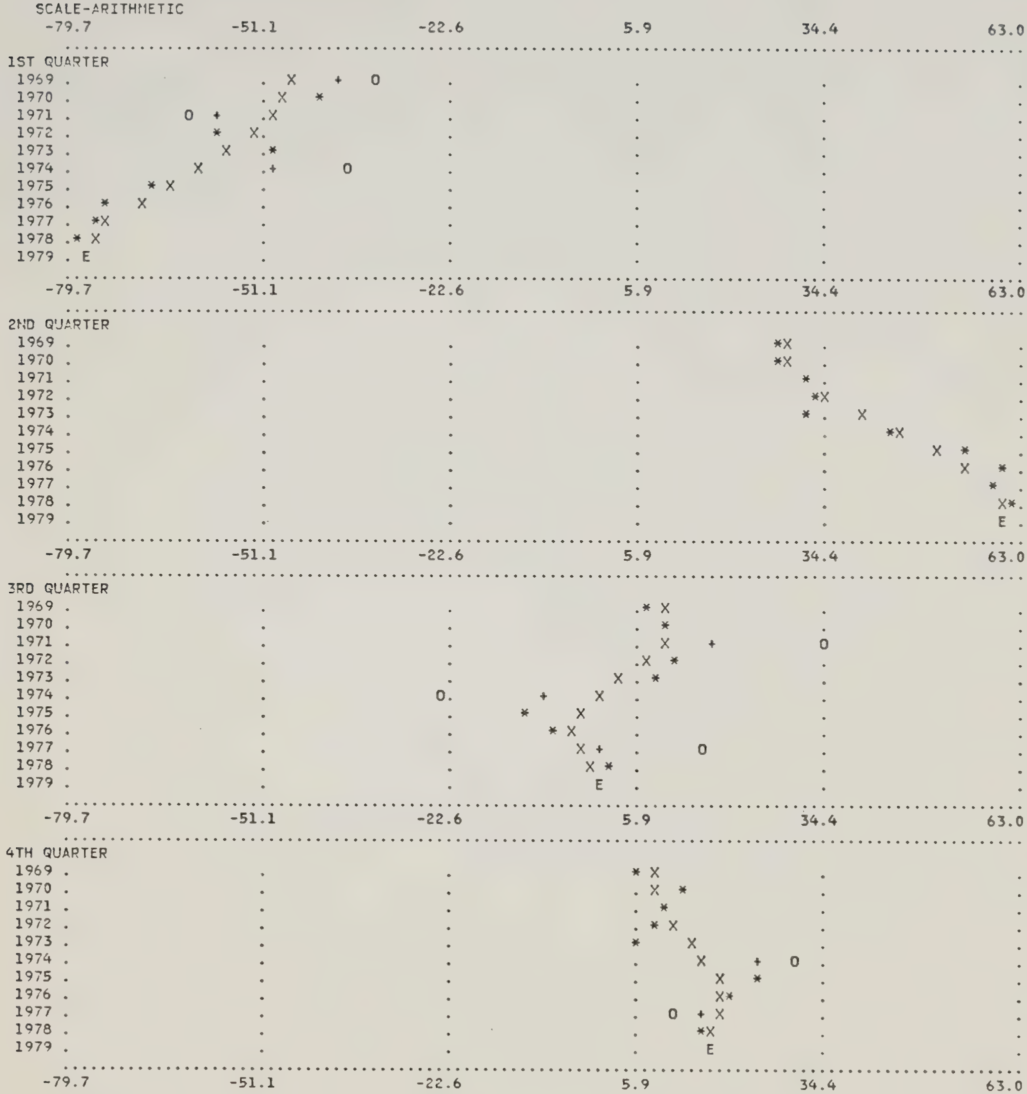


FREIGHT AND SHIPPING PAYMENTS

G 3. CHART

(X) - D10. FINAL SEASONAL FACTORS
(O) - D 8. FINAL UNMODIFIED SI DIFFERENCES
(+) - D 9. FINAL DIFFERENCES MODIFIED FOR EXTREMES
(*) - COINCIDENCE OF POINTS
(E) - EXTRAPOLATED SEASONAL FACTORS

SCALE-ARITHMETIC



Direct Versus Indirect
Seasonal Adjustment of Unemployed
Both Sexes, 16 to 19 –
Monthly Brief Printout

```
C
M3  0030  01671278    1  11      2
 011011
T          0030  UNEMPLOYMENT MEN 16-19 YEARS
  003067   391   425   372   363   337   753   620   455   375   431   450   402
  003068   385   417   400   320   292   778   627   396   339   368   385   410
  003069   426   405   413   352   304   675   663   407   407   403   420   410
  003070   479   500   475   483   440   947   807   585   580   602   619   668
  003071   706   654   636   572   550   978   924   678   595   635   657   701
  003072   755   832   744   614   550   925   811   698   636   584   665   671
  003073   605   646   600   587   521   892   833   608   588   571   666   645
  003074   707   708   665   581   559  1049   941   675   764   701   817   827
  003075   972   961   923   883   818  1340  1208   967   854   829   857   868
  003076   997   941   896   901   801  1160  1089   888   830   843   912   875
  003077   884   924   890   753   722  1220  1038   855   786   739   808   712
  003078   807   881   838   720   621   997   974   735   713   741   778   803
M3  0041  01671278    1  11      2
 011011
T          0041  UNEMPLOYMENT WOMEN 16-19 YEARS
  004167   276   346   276   260   269   710   584   446   394   397   409   320
  004168   265   352   322   299   324   820   675   427   402   355   391   317
  004169   276   323   322   322   319   761   587   458   435   434   388   325
  004170   385   378   387   400   335   835   644   552   552   530   616   462
  004171   462   473   506   459   432   900   803   594   595   526   587   466
  004172   512   524   535   520   402   956   813   648   623   563   565   477
  004173   445   555   504   521   465   901   738   566   621   548   581   497
  004174   564   552   561   448   523  1004   908   618   715   699   696   633
  004175   759   693   753   638   735  1094   969   856   819   773   726   732
  004176   740   713   726   650   633  1087   920   903   773   726   726   683
  004177   796   712   758   683   675  1147   919   799   824   741   734   581
  004178   732   689   711   638   696  1060   953   807   799   689   701   644
C  0050   01671278    1  11      2
 011011
T          UNEMPLOYMENT BOTH SEXES 16-19 YEARS
Z
```

STATISTICS CANADA

X-11 ARIMA MONTHLY SEASONAL ADJUSTMENT METHOD

THIS METHOD MODIFIES THE X-11 VARIANT OF CENSUS METHOD II
BY J. SHISKIN, A.H. YOUNG AND J.C. MUSGRAVE OF FEBRUARY, 1967.
THE MODIFICATIONS MADE ARE BASED ON THE METHODOLOGICAL RESEARCH
DEVELOPED BY ESTELA BEE DAGUM, CHIEF OF THE SEASONAL ADJUSTMENT
AND TIME SERIES STAFF OF STATISTICS CANADA. SEPTEMBER, 1979.

SERIES TITLE-   UNEMPLOYMENT BOTH SEXES 16-19 YEARS   SERIES NO. 0050

-PERIOD COVERED- 1ST   MONTH,1967 TO 12TH   MONTH,1978
-TYPE OF RUN -   ADDITIVE SEASONAL ADJUSTMENT
-   BRIEF PRINTOUT.   NO CHARTS.
-SIGMA LIMITS FOR GRADUATING EXTREME VALUES ARE 1.5 AND 2.5 .
-ONE YEAR OF FORECASTS AND BACKCASTS FROM AN ARIMA MODEL SELECTED BY THE USER.

```
                                        1         2         3         4         5         6         7         8
COLUMN NUMBER                : 12345678901234567890123456789012345678901234567890123456789012345678901234567890

 IMAGE OF THE MAIN OPTION CARD: C  0050    01671278    1  11      2
IMAGE OF THE ARIMA OPTION CARD:  011011
```

UNEMPLOYMENT BOTH SEXES 16-19 YEARS

A 1. ORIGINAL SERIES

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
1967	667.	771.	648.	623.	606.	1463.	1204.	901.	769.	828.	859.	722.	10061.
1968	650.	769.	722.	619.	616.	1598.	1302.	823.	741.	723.	776.	727.	10066.
1969	702.	728.	735.	674.	623.	1436.	1250.	865.	842.	837.	808.	735.	10235.
1970	864.	878.	862.	883.	775.	1782.	1451.	1137.	1132.	1132.	1235.	1130.	13261.
1971	1168.	1127.	1142.	1031.	982.	1878.	1727.	1272.	1190.	1161.	1244.	1167.	15089.
1972	1267.	1356.	1279.	1134.	952.	1881.	1624.	1346.	1259.	1147.	1230.	1148.	15623.
1973	1050.	1201.	1104.	1108.	986.	1793.	1571.	1174.	1209.	1119.	1247.	1142.	14704.
1974	1271.	1260.	1226.	1029.	1082.	2053.	1849.	1293.	1479.	1400.	1513.	1460.	16915.
1975	1731.	1654.	1676.	1521.	1553.	2434.	2177.	1823.	1673.	1602.	1583.	1600.	21027.
1976	1737.	1654.	1622.	1551.	1434.	2247.	2009.	1791.	1603.	1569.	1638.	1558.	20413.
1977	1680.	1636.	1648.	1436.	1397.	2367.	1957.	1654.	1610.	1480.	1542.	1293.	19700.
1978	1539.	1570.	1549.	1358.	1317.	2057.	1927.	1542.	1512.	1430.	1479.	1447.	18727.
AVGE	1194.	1217.	1184.	1081.	1027.	1916.	1671.	1302.	1252.	1202.	1263.	1177.	

TABLE TOTAL- 185821. MEAN- 1290. STD. DEVIATION- 407.

AUTOREGRESSIVE INTEGRATED MOVING AVERAGE (ARIMA) EXTRAPOLATION PROGRAM

A5. ARIMA EXTRAPOLATION MODEL (FORECAST)

THIS PROGRAM WAS DEVELOPED FOLLOWING THE PROCEDURES OUTLINED IN 'TIME SERIES ANALYSIS' BY G. E. P. BOX AND G. M. JENKINS.

MODEL	TRAN.	ADDITIVE CONSTANT	AVERAGE PERCENTAGE STANDARD ERROR IN FORECASTS: LAST 3 YEARS	LAST YEAR	LAST-1 YEAR	LAST-2 YEAR	CHI-SQ. PROB.	R-SQUARED VALUE	ESTIMATED PARAMETERS
(0,1,1)(0,1,1)	NONE	0.0	5.38	3.23	7.18	5.74	15.67%	0.9577	0.4357E 00 0.7139E 00

THE MODEL CHOSEN IS (0,1,1)(0,1,1)0 WITH TRANSFORMATION - NONE

AUTOREGRESSIVE INTEGRATED MOVING AVERAGE (ARIMA) EXTRAPOLATION PROGRAM

A6. ARIMA EXTRAPOLATION MODEL (BACKCAST)

THIS PROGRAM WAS DEVELOPED FOLLOWING THE PROCEDURES OUTLINED IN 'TIME SERIES ANALYSIS' BY G. E. P. BOX AND G. M. JENKINS.

MODEL	TRAN.	ADDITIVE CONSTANT	AVERAGE PERCENTAGE STANDARD ERROR IN BACKCASTS: LAST 3 YEARS	LAST YEAR	LAST-1 YEAR	LAST-2 YEAR	CHI-SQ. PROB.	R-SQUARED VALUE	ESTIMATED PARAMETERS
(0,1,1)(0,1,1)	NONE	0.0	12.17	15.47	16.88	4.18	17.30%	0.9606	0.4052E 00 0.6986E 00

THE MODEL CHOSEN IS (0,1,1)(0,1,1)0 WITH TRANSFORMATION - NONE

UNEMPLOYMENT BOTH SEXES 16-19 YEARS

B 1. ORIGINAL SERIES

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
1966	600.	666.	611.	546.	504.	1402.	1151.	777.	706.	702.	748.	657.	9072.
1967	667.	771.	648.	623.	606.	1463.	1204.	901.	769.	828.	859.	722.	10061.
1968	650.	769.	722.	619.	616.	1598.	1302.	823.	741.	723.	776.	727.	10066.
1969	702.	728.	735.	674.	623.	1436.	1250.	865.	842.	837.	808.	735.	10235.
1970	864.	878.	862.	883.	775.	1782.	1451.	1137.	1132.	1132.	1235.	1130.	13261.
1971	1168.	1127.	1142.	1031.	982.	1878.	1727.	1272.	1190.	1161.	1244.	1167.	15089.
1972	1267.	1356.	1279.	1134.	952.	1881.	1624.	1346.	1259.	1147.	1230.	1148.	15623.
1973	1050.	1201.	1104.	1108.	986.	1793.	1571.	1174.	1209.	1119.	1247.	1142.	14704.
1974	1271.	1260.	1226.	1029.	1082.	2053.	1849.	1293.	1479.	1400.	1513.	1460.	16915.
1975	1731.	1654.	1676.	1521.	1553.	2434.	2177.	1823.	1673.	1602.	1583.	1600.	21027.
1976	1737.	1654.	1622.	1551.	1434.	2247.	2009.	1791.	1603.	1569.	1638.	1558.	20413.
1977	1680.	1636.	1648.	1436.	1397.	2367.	1957.	1654.	1610.	1480.	1542.	1293.	19700.
1978	1539.	1570.	1549.	1358.	1317.	2057.	1927.	1542.	1512.	1430.	1479.	1447.	18727.
AVGE	1148.	1175.	1140.	1039.	987.	1876.	1631.	1261.	1210.	1164.	1223.	1137.	

TABLE TOTAL- 194893. MEAN- 1249. STD. DEVIATION- 422.

ORIGINAL SERIES EXTRAPOLATED ONE YEAR AHEAD

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
1979	1565.	1559.	1539.	1389.	1342.	2198.	1956.	1607.	1552.	1475.	1534.	1442.	19158.

D10. FINAL SEASONAL FACTORS
3X5 MOVING AVERAGE SELECTED.

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	AVGE
1967	-121.	-69.	-130.	-193.	-231.	630.	389.	14.	-67.	-64.	-34.	-129.	-0.
1968	-113.	-74.	-125.	-187.	-234.	625.	386.	11.	-65.	-67.	-35.	-130.	-1.
1969	-100.	-75.	-115.	-184.	-241.	618.	380.	8.	-62.	-78.	-35.	-127.	-1.
1970	-85.	-72.	-106.	-185.	-246.	608.	374.	5.	-55.	-90.	-36.	-128.	-1.
1971	-68.	-62.	-98.	-193.	-252.	605.	368.	1.	-48.	-105.	-36.	-128.	-1.
1972	-47.	-53.	-93.	-209.	-254.	607.	368.	1.	-47.	-119.	-40.	-132.	-2.
1973	-27.	-43.	-87.	-226.	-254.	610.	368.	5.	-50.	-131.	-48.	-133.	-1.
1974	-10.	-41.	-79.	-237.	-250.	611.	367.	7.	-52.	-137.	-57.	-137.	-1.
1975	-2.	-39.	-69.	-240.	-250.	612.	364.	7.	-52.	-137.	-65.	-140.	-1.
1976	1.	-40.	-59.	-236.	-250.	611.	361.	8.	-54.	-136.	-71.	-141.	-0.
1977	-4.	-36.	-49.	-228.	-252.	605.	355.	8.	-53.	-133.	-73.	-141.	-0.
1978	-11.	-34.	-44.	-220.	-252.	600.	349.	5.	-50.	-131.	-71.	-141.	0.
AVGE	-49.	-53.	-88.	-211.	-247.	612.	369.	7.	-55.	-111.	-50.	-134.	

TABLE TOTAL- -118. MEAN- -1. STD. DEVIATION- 236.

D10A. SEASONAL FACTORS, ONE YEAR AHEAD

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	AVGE
1979	-17.	-31.	-40.	-217.	-254.	598.	347.	2.	-45.	-130.	-70.	-142.	-0.

UNEMPLOYMENT BOTH SEXES 16-19 YEARS

D11. FINAL SEASONALLY ADJUSTED SERIES

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
1967	788.	840.	778.	816.	837.	833.	815.	887.	836.	892.	893.	851.	10065.
1968	763.	843.	847.	806.	850.	973.	916.	812.	806.	790.	811.	857.	10076.
1969	802.	803.	850.	858.	864.	818.	870.	857.	904.	915.	843.	862.	10245.
1970	949.	950.	968.	1068.	1021.	1174.	1077.	1132.	1187.	1222.	1271.	1258.	13276.
1971	1236.	1189.	1240.	1224.	1234.	1273.	1359.	1271.	1238.	1266.	1280.	1295.	15104.
1972	1314.	1409.	1372.	1343.	1206.	1274.	1256.	1345.	1306.	1266.	1270.	1280.	15642.
1973	1077.	1244.	1191.	1334.	1240.	1183.	1203.	1169.	1259.	1250.	1295.	1275.	14720.
1974	1281.	1301.	1305.	1266.	1332.	1442.	1482.	1286.	1531.	1537.	1570.	1597.	16929.
1975	1733.	1693.	1745.	1761.	1803.	1822.	1813.	1816.	1725.	1739.	1648.	1740.	21036.
1976	1736.	1694.	1681.	1787.	1684.	1636.	1648.	1783.	1657.	1705.	1709.	1699.	20419.
1977	1684.	1672.	1697.	1664.	1649.	1762.	1602.	1646.	1663.	1613.	1615.	1434.	19701.
1978	1550.	1604.	1593.	1578.	1569.	1457.	1578.	1537.	1562.	1561.	1550.	1588.	18725.
AVGE	1243.	1270.	1272.	1292.	1274.	1304.	1301.	1295.	1306.	1313.	1313.	1311.	

TABLE TOTAL- 185939. MEAN- 1291. STD. DEVIATION- 327.

X-11 ARIMA

INDIRECT SEASONAL ADJUSTMENT OF COMPOSITE SERIES

STATISTICS CANADA, MARCH,1979

SERIES TITLE- UNEMPLOYMENT BOTH SEXES 16-19 YEARS SERIES NO. 0050

PERIOD COVERED- 1/67 TO 12/78.

THERE ARE 2 COMPONENTS IN THE COMPOSITE.

D10. FINAL SEASONAL FACTORS
3X5 MOVING AVERAGE SELECTED.

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	AVGE
1967	-136.	-70.	-130.	-194.	-231.	645.	397.	16.	-70.	-68.	-33.	-130.	-0.
1968	-128.	-75.	-125.	-188.	-235.	641.	396.	12.	-68.	-72.	-36.	-130.	-1.
1969	-114.	-79.	-115.	-184.	-243.	635.	394.	8.	-64.	-82.	-40.	-127.	-1.
1970	-96.	-81.	-107.	-179.	-249.	624.	391.	2.	-58.	-95.	-41.	-128.	-1.
1971	-75.	-76.	-100.	-176.	-257.	617.	384.	-4.	-50.	-110.	-44.	-129.	-2.
1972	-51.	-68.	-95.	-182.	-260.	612.	380.	-4.	-48.	-122.	-51.	-134.	-2.
1973	-27.	-57.	-88.	-193.	-261.	609.	373.	-0.	-50.	-132.	-60.	-136.	-2.
1974	-8.	-50.	-80.	-202.	-257.	606.	365.	4.	-51.	-136.	-68.	-140.	-1.
1975	1.	-42.	-69.	-209.	-255.	604.	356.	7.	-50.	-136.	-75.	-142.	-1.
1976	4.	-38.	-57.	-215.	-253.	601.	352.	9.	-52.	-134.	-80.	-142.	-0.
1977	0.	-34.	-46.	-216.	-252.	594.	350.	9.	-52.	-131.	-79.	-141.	0.
1978	-6.	-31.	-41.	-213.	-252.	588.	346.	6.	-49.	-130.	-74.	-141.	0.
AVGE	-53.	-58.	-88.	-196.	-250.	615.	374.	5.	-55.	-112.	-57.	-135.	

TABLE TOTAL- -128. MEAN- -1. STD. DEVIATION- 237.

D10A. SEASONAL FACTORS, ONE YEAR AHEAD

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	AVGE
1979	-10.	-30.	-39.	-212.	-251.	586.	344.	5.	-47.	-129.	-71.	-141.	0.

UNEMPLOYMENT BOTH SEXES 16-19 YEARS

D11. FINAL SEASONALLY ADJUSTED SERIES

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
1967	803.	841.	778.	817.	837.	818.	807.	885.	839.	896.	892.	852.	10065.
1968	778.	844.	847.	807.	851.	957.	906.	811.	809.	795.	812.	857.	10075.
1969	816.	807.	850.	858.	866.	801.	856.	857.	906.	919.	848.	862.	10247.
1970	960.	959.	969.	1062.	1024.	1158.	1060.	1135.	1190.	1227.	1276.	1258.	13278.
1971	1243.	1203.	1242.	1207.	1239.	1261.	1343.	1276.	1240.	1271.	1288.	1296.	15109.
1972	1318.	1424.	1374.	1316.	1212.	1269.	1244.	1350.	1307.	1269.	1281.	1282.	15646.
1973	1077.	1258.	1192.	1301.	1247.	1184.	1198.	1174.	1259.	1251.	1307.	1278.	14724.
1974	1279.	1310.	1306.	1231.	1339.	1447.	1484.	1289.	1530.	1536.	1581.	1600.	16930.
1975	1730.	1696.	1745.	1730.	1808.	1830.	1821.	1816.	1723.	1738.	1658.	1742.	21036.
1976	1733.	1692.	1679.	1766.	1687.	1646.	1657.	1782.	1655.	1703.	1718.	1700.	20417.
1977	1680.	1670.	1694.	1652.	1649.	1773.	1608.	1645.	1662.	1611.	1621.	1434.	19698.
1978	1545.	1601.	1590.	1571.	1569.	1469.	1581.	1536.	1561.	1560.	1553.	1588.	18723.
AVGE	1247.	1275.	1272.	1276.	1277.	1301.	1297.	1296.	1307.	1315.	1319.	1312.	

TABLE TOTAL- 185949. MEAN- 1291. STD. DEVIATION- 327.

MEASURES OF ROUGHNESS R1 AND R2 FOR SEASONALLY ADJUSTED SERIES

	DIRECT		INDIRECT		PERCENTAGE CHANGE	
	FULL SERIES	LAST THREE YEARS	FULL SERIES	LAST THREE YEARS	FULL SERIES	LAST THREE YEARS
R1-MEAN SQUARE ERROR	4892.219	5399.961	4708.230	5118.684	3.761%	5.209%
R1-ROOT MEAN SQUARE ERROR	69.944	73.484	68.617	71.545	1.898%	2.639%
R2-MEAN SQUARE ERROR	2090.647	2374.917	2042.854	2271.957	2.286%	4.335%
R2-ROOT MEAN SQUARE ERROR	45.724	48.733	45.198	47.665	1.150%	2.192%

POSITIVE PERCENTAGE CHANGES INDICATE THAT THE INDIRECT SEASONALLY ADJUSTED COMPOSITE IS SMOOTHER THAN THE DIRECT SEASONALLY ADJUSTED COMPOSITE.

Appendix A

THE X-11-ARIMA SPECIFICATIONS

Symbolic Notation

Description	Multiplicative	Additive or log additive
Original series (O) composed of trend-cycle (C), seasonal (S), trading-day (D), and irregular (I") variations.	$O = C\,S\,I''\,D$; $D = D_p\,D_r$; D_p = Prior trading-day adjustment factors; D_r = Any residual trading-day variation left after applying D_p (or all trading-day variation if no prior trading-day factors are used);	$O = C+S+I''+D$; $D = D_r$; D_r = All trading-day variation;
Irregular variations (I") include holiday variation, major strikes, etc., which may be removed by prior adjustment factors (P), plus extremes (E) and residual or "true" irregular (I). Extremes are defined as irregular values falling outside 2.5 standard deviations (σ's). For the purpose of ARIMA extrapolation these extreme values can be replaced by the corresponding function values of a fitted ARIMA model chosen in a first iteration. For the purpose of fitting curves in Parts C and D, the unmodified irregular (I) values are assigned linearly graduated weights varying between 0.0 and 1.0 for values between 2.5σ and 1.5σ. Values within 1.5σ receive full weight.	$I'' = P\,E\,I$; $I' = E\,I$, where $E = \lvert I' - 1.0 \rvert > 2.5\sigma_{I'}$; $I^w = 1.0 + w\,(I' - 1.0)$; where $w = 0.0$ when $\lvert I' - 1.0 \rvert > 2.5\sigma_{I'}$ $= 1.0$ when $\lvert I' - 1.0 \rvert < 1.5\sigma_{I'}$ $= 2.5 - \lvert I' - 1.0 \rvert / \sigma_{I'}$ when $1.5\sigma_{I'} \leq \lvert I' - 1.0 \rvert \leq 2.5\sigma_{I'}$.	$I'' = P+E+I$; $I' = E+I$, where $E = \lvert I' \rvert > 2.5\sigma_{I'}$; $I^w = I'\,w$, where $w = 0.0$ when $\lvert I' \rvert > 2.5\sigma_{I'}$ $= 1.0$ when $\lvert I' \rvert < 1.5\sigma_{I'}$ $= 2.5 - \lvert I' \rvert / \sigma_{I'}$ when $1.5\sigma_{I'} \leq \lvert I' \rvert \leq 2.5\sigma_{I'}$.
The selection of 1.5 and 2.5 as σ limits is optional. For special purposes other limits may be advisable. (See Chapter III.)	In general, if U = upper σ limit and L = lower σ limit, $w = \frac{U}{U-L} - \frac{1.0}{U-L}\left[\lvert I' - 1.0 \rvert / \sigma_{I'}\right]$ when $L\sigma_{I'} \leq \lvert I' - 1.0 \rvert \leq U\sigma_{I'}$. $M_i \boxed{Y}$ represents a moving average of length i computed from series Y. NOTE: The irregular (I) is presented here as having a mean of 1.000 although it is shown in the computer printout as a percentage with a mean of 100.0. Seasonal, trading-day, and prior factors are also shown as percentages.	In general, if U = upper σ limit and L = lower σ limit, $w = \frac{U}{U-L} - \frac{1.0}{U-L}\left[\lvert I' \rvert / \sigma_{I'}\right]$ when $L\sigma_{I'} \leq \lvert I' \rvert \leq U\sigma_{I'}$. $M_i \boxed{Y}$ represents a moving average of length i computed from series Y.

Specifications – Monthly X-11-ARIMA

Part A. Prior Adjustments

This part describes the various prior adjustments that the user should make to the original unadjusted series, when applicable, to produce efficient estimates of the seasonal and trading-day factors. If no prior adjustments are needed, the computations start with those described in Part B.

Part A. Prior Adjustments – Continued

Table number and title	Multiplicative and additive or log additive	Symbolic notation	
		Multiplicative	Additive or log additive
	NOTE: Additive descriptions are **(underlined).**		
A1. Original series	Original monthly time series.	$O = C\ S\ I''\ D$.	$O = C+S+I''+D_r$.
A2. Prior monthly adjustment factors	To adjust for the effect of certain holidays, change the level of the series, etc., the user may supply monthly adjustment factors.	P.	P.
A3. Original series adjusted by prior monthly adjustment factors	Divide the A2 factors into **(subtract the A2 factors from)** the original data (A1).	$O/P = C\ S\ I'D$.	$O-P = C+S+I'+D_r$.
A4. Prior trading-day adjustment factors	To adjust for trading-day variation, the user may supply seven daily weights from which the computer constructs monthly adjustment factors that are divided into (A1) or (A3). The computer adjusts the seven daily weights to total 7.000. For the multiplicative case, the monthly calendar factors are computed by the formula: $M_i = \frac{X_{1i}\,(D_{p1}) + X_{2i}\,(D_{p2}) + \ldots + X_{7i}\,(D_{p7})}{N_i}$, where M_i is the monthly factor for month i; X_{ji} is the number of times that day-of-the-week j occurs in month i; Dp_j is the prior daily weight for day-of-the week j; N_i is 31, 30, or 28.25 depending upon whether month i is a 31- or 30-day month or February. If length-of-month variation is to be included in the trading-day factors, N_i is 30.4375 for all months. This option is not available for the additive case. The result is printed in Table B1. A similar trading-day adjustment can be based upon factors estimated from the data in Parts B and C, below.	D_p. $\frac{C\ S\ I'D}{D_p} = C\ S\ I\ D_r$.	NA NA
A5. ARIMA extrapolation model (forecast)	To extend the series with one extra year of forecasts, three ARIMA models are automatically fitted to the original series or, if applicable, to the original series modified by A2, A4 and extreme values replaced by the corresponding function values of the ARIMA model chosen in a first iteration. Thus, a prior treatment of extreme values consists of testing the residuals from the fitted ARIMA model of the first iteration that fulfills the criteria for acceptance (see below) against $\pm 2.5\sigma$. The values that fall outside this interval are replaced by the corresponding function values. The same ARIMA model is then fitted to the modified data to produce the forecasts. No model is automatically selected and no forecasts are made if: (1) the absolute average forecasting error for the last three years, is greater than 12%; (2) the chi-square probability value is smaller than 10%; or (3) there are evidences of overdifferencing. These criteria of acceptance apply only to the three program-supplied models and not to a user-supplied model.		

Part A. Prior Adjustments – Concluded

Table number and title	Multiplicative and additive or log additive	Symbolic notation	
		Multiplicative	Additive or log additive
A6. ARIMA extrapolation model (backcast)	To extend the series with one extra year of backcasts, the model selected in A5 is applied if: (1) the absolute average back-casting error for the last three years is smaller than 18%; (2) the chi-square probability is greater than 10% and (3) there are no evidences of overdifferencing. These criteria of acceptance apply only to the program-supplied models and no forecasts or backcasts are made if they fail. They do not apply to a user-supplied model.		

Part B. Preliminary Estimation of Trading-day Variation and Weights

Preliminary trading-day adjustment factors and weights for reducing the effect of extreme or near-extreme irregular values are developed from the data. These estimates are refined in Part C, where final estimates are developed.

Table number and title	Multiplicative and additive or log additive	Symbolic notation	
		Multiplicative	Additive or log additive
B1. Prior adjusted original series or original series	Either the original series or original series adjusted by: (1) the prior factors shown in A2; and/or (2) the prior factors shown in A4; and/or (3) the prior ARIMA modifications. The latter consists of extending the original series, at both ends, with one year of backcasts and forecasts or only-forecasts, from the ARIMA model chosen in A5 and A6 and, if applicable, replacement of extreme values by the corresponding function values of the ARIMA model chosen. An F test for the presence of seasonality (see Chapter I) is applied to B1 and a message is printed to indicate whether or not seasonality is present at the 0.1% level.	$C\,S\,I'D_r$.	$C+S+I'+D_r$.
B2. Preliminary trend-cycle	Compute a centred 12-term moving average (a 2-term average of a 12-term average) of (B1) as an estimate of the trend-cycle. The user has the option of computing a centred 24-term moving average (2-term average of a 24-term average) of B1 as a preliminary estimate of the trend-cycle (see Chapter I).	$M_C[C\,S\,I'D_r] = C_1$.	$M_C[C+S+I'+D_r] = C_1$.
B3. Unmodified S–I ratios (**differences**)	Divide (B2) into (B1) (**subtract (B2) from (B1)**) to obtain seasonal-irregular (S–I) ratios (**differences**).	$C\,S\,I'D_r/C_1 =$ $S\,I'D_r$.	$(C+S+I'+D_r) - C_1 =$ $S+I'+D_r$.
B4. Replacement values for extreme S–I ratios (**differences**)	To the B3 S–I ratios (**differences**), apply a weighted 5-term moving average separately to each month to estimate preliminary seasonal factors. See Appendix B for the weights for the 5-term (3 x 3) average.	$M_S[S\,I'D_r] = S$.	$M_S[S+I'+D_r] = S$.

Part B. Preliminary Estimation of Trading-day Variation and Weights – Continued

Table number and title	Multiplicative and additive or log additive	Symbolic notation: Multiplicative	Symbolic notation: Additive or log additive
B4. Replacement values for extreme S–I ratios **(differences)** – Concluded	Compute a centred 12-term moving average of the preliminary factors for the entire series. To obtain the six missing values at either end of this average, repeat the first (last) available moving average value six times. Adjust the factors to sum to 12.000 (0.000) (approximately) over any 12-month period by dividing **(subtracting)** the centered 12-term average into **(from)** the factors.		
	Divide the seasonal factor estimate into the S–I ratios **(subtract the seasonal factor estimates from the S–I differences)** to obtain an estimate of the irregular component.	$S\,I'\,D_r/S = I'D_r$.	$(S+I'+D_r) - S = I'+D_r$
	Compute a moving five-year standard deviation (σ) of the estimates of the irregular component and test the irregulars in the central year of the five-year period against 2.5σ. Remove values beyond 2.5σ as extreme and recompute the moving five-year σ.		
	Assign a zero weight to irregulars beyond 2.5σ and a weight of 1.0 (full weight) to irregulars within 1.5σ. Assign a linearly graduated weight between 0.0 and 1.0 to irregular between 2.5σ and 1.5σ.		
	For values receiving less than full weight, the corresponding S–I ratios **(differences)** are replaced with an average of the ratio **(difference)** times its weight and the two nearest preceding and two nearest following full-weight ratios **(differences)** for that month.	$I' = I^w$ for $\lvert I' - 1.0 \rvert > 1.5\sigma_{I'}$.	$I' = I^w$ for $\lvert I' \rvert > 1.5\sigma_{I'}$
	For the first two years, the σ limits computed for the third year are used; and for the last two years, the σ limits computed for the third-from-end year are used. To replace an extreme ratio **(difference)** in either of the two beginning or ending years, the average of the ratio **(difference)** times its weight and the three nearest full-weight ratios **(differences)** for that month is taken.		
	The moving five-year σ's and the replacement values for the extreme S–I ratios **(differences)** are shown in Table B4.	$S\,I^w\,D_r$.	$S+I^w+D_r$.
B5. Seasonal factors	To the B3 S–I ratios **(differences)** with extreme values replaced by the corresponding B4 values apply a weighted 5-term average to each month separately to estimate preliminary seasonal factors.	$M_S[S\,I^w\,D_r] = S_1$.	$M_S[S+I^w+D_r] = S_1$.
	Adjust the factors to sum to 12.000 using a centered 12-term moving average (see second paragraph in B4).		
	To obtain factors for the six missing values at either end of the series due to the use of the centered 12-term trend-cycle moving average in step B2, repeat the nearest available factor for that particular month.		
B6. Seasonally adjusted series	Divide (B5) into (B1) **(subtract (B5) from (B1))** to obtain a preliminary seasonally adjusted series.	$C\,S\,I'D_r/S_1 = C\,I'\,D_r$.	$(C+S+I'+D_r) - S_1 = C+I'+D_r$.
B7. Trend-cycle	Apply the variable trend-cycle curve routine (modified so that the weighted 13-term average is selected for $\overline{I}/\overline{C} > 0.99$) to (B6). See note at the end of these specifications for details of the variable trend-cycle curve routine.	$M_C[C\,I'\,D_r] = C_2$.	$M_C[C+I'+D_r] = C_2$.

Part B. Preliminary Estimation of Trading-day Variation and Weights – Continued

Table number and title	Multiplicative and additive or log additive	Symbolic notation	
		Multiplicative	Additive or log additive
B 7. Trend-cycle – Concluded	Adjustment of Trend-Cycle for Strikes (optional). The effects of extreme values on the B7 trend-cycle component are reduced by the optional computations in the remainder of step B7, below. These computations can be of use when adjusting series affected by major prolonged strikes or similar irregular occurrences. See Chapter III for the selection of this option.		
	Divide (subtract) the trend-cycle estimates provided by the variable trend-cycle curve routine into (from) the seasonally adjusted series to obtain an estimate of the irregular.	$C\,I'D_r/C = I'D_r$.	$(C+I'+D_r) - C = I'+D_r$.
	Compute a moving five-year standard deviation of the monthly estimates of the irregular component and test the irregulars in the central year of the five-year period against 2.5σ limits. Remove values beyond 2.5σ and recompute σ.		
	Assign a zero weight to irregulars beyond $2.5\ \sigma$ and a weight of 1.0 (full weight) to irregulars within $1.5\ \sigma$. Assign a linearly graduated weight between 0.0 and 1.0 to irregulars between $2.5\ \sigma$ and $1.5\ \sigma$.		
	For values receiving less than full weight, the corresponding seasonally adjusted values are replaced with an average of the value times its weight and the two nearest full-weight preceding and two nearest full-weight following seasonally adjusted values.	$I' = I^w$ for $\lvert I' - 1.0 \rvert > 1.5\sigma_{I'}$.	$I' = I^w$ for $\lvert I' \rvert > 1.5\sigma_{I'}$.
	For the first two years, the σ limits computed for the third year are used; and for the last two years, the σ limits computed for the third-from-end year are used. To replace an extreme value in either of the two beginning or ending years, the average of the value times its weight and three nearest full-weight values is taken.	$C\,I^w\,D_r$.	$C+I^w+D_r$.
	To the seasonally adjusted values modified for extremes, apply the variable trend-cycle curve routine to estimate a preliminary trend-cycle which is shown in B7.	$M_C[C\,I^w\,D_r] = C_2$.	$M_C[C+I^w+D_r] = C_2$.
B 8. Unmodified S–I ratios (differences)	Same as B3 except that B7 trend-cycle values are used.	$C\,S\,I'\,D_r/C_2 = S\,I'\,D_r$.	$(C+S+I'+D_r) - C_2 = S+I'+D_r$.
B 9. Replacement values for extreme S–I ratios (differences)	Same as B4 except that B8 S–I ratios (differences) are used and that a weighted 7-term average is applied to estimate seasonal factors. See Appendix B for the weights for the 7-term (3 x 5) average.	$M_S[S\,I'\,D_r] = S$. $S\,I'D_r/S = I'D_r$. $I' = I^w$ for $\lvert I' - 1.0 \rvert > 1.5\sigma_{I'}$. $S\,I^w\,D_r$.	$M_S[S+I'+D_r] = S$. $(S+I'+D_r) - S = I'+D_r$. $I' = I^w$ for $\lvert I' \rvert > 1.5\sigma_{I'}$. $S+I^w+D_r$.
B10. Seasonal factors	To the B8 S–I ratios (differences) with extreme values replaced by the corresponding B9 values, apply the weighted 7-term average to each month separately to estimate preliminary seasonal factors.	$M_S[S\,I^wD_r] = S_2$.	$M_S[S+I^w+D_r] = S_2$.
	Adjust the factors to sum to 12.000 using a centered 12-term moving average. (See second paragraph in B4.)		
B11. Seasonally adjusted series	Same as B6 except that B10 seasonal factors are used.	$C\,S\,I'D_r/S_2 = C\,I'\,D_r$.	$(C+S+I'+D_r) - S_2 = C+I'+D_r$.
B12. Not used			

Part B. Preliminary Estimation of Trading-day Variation and Weights – Continued

Table number and title	Multiplicative and additive or log additive	Symbolic notation: Multiplicative	Symbolic notation: Additive or log additive
B13. Irregular series	Divide (B7) into **(subtract (B7) from)** (B11) to obtain a preliminary irregular series. Adjustment for Trading-Day Variation (optional). Steps B14 to B16 and B18 to B19 are included only when a trading-day adjustment based upon the information in the monthly series is desired. To adjust for trading days on the basis of external information, Table A4 is used. Various combinations of these options are described in Chapter III.	$C\,I'D_r/C_2 = I'D_r$.	$(C{+}I'{+}D_r) - C_2 = I'{+}D_r$.
B14. Extreme irregular values excluded from trading-day regression	Sort B13 irregulars for 31-day months into seven groups depending upon the day of the week the month begins. Likewise, sort 30-day months into seven groups. For February, separate leap years from non-leap years. For 31- and 30-day months and non-leap-year Februaries, compute the mean of each group and the squared deviations of the values from their respective means. From these, compute a "trading-day" variance (σ_t^2) over the entire series, which is used to identify extremes. Identify and remove values beyond 2.5 σ_t limits. (The built-in σ limit is 2.5, but a different limit for identifying extremes may be specified in the option card.) See Chapter III. Recompute the means and σ_t and re-identify and remove extremes beyond 2.5 σ_t. For leap-year Februaries, throw out values that deviate from 1.0 **(0.0)** by more than 2.5 σ_t. Values removed as extremes are shown in Table B14. They are not included in the trading-day regression in B15.	For $\lvert I'-1.0 \rvert >$ 2.5 σ_t $I'D_r$ removed from regression.	For $\lvert I' \rvert > 2.5\,\sigma_t$ $[I'{+}D_r]$ removed from regression.
B15. Preliminary trading-day regression	Estimate by least squares seven daily weights from the B13 irregular (with extremes omitted) using the specification: **Multiplicative:** $(I\,D_r)_i - 1.0 = \dfrac{X_{1i}B_1+X_{2i}B_2+\cdots+X_{7i}B_7+I_i;}{N_i}$ where $(I\,D_r)_i$ is the irregular component for month i with residual trading-day variation; **Additive:** $[I{+}D_r]_i = X_{1i}B_1+X_{2i}B_2+\cdots+X_{7i}B_7+I_i;$ where $[I{+}D_r]_i$ is the irregular component for month i with residual trading-day variation; X_{ji} is the number of times that day-of-the-week j occurs in month i; Monday = 1, - - -, Sunday = 7; B_j's are the seven "true" daily weights, where $\sum_{1}^{7} B_j = 0$; N_i is either 31, 30, or 28.25, if no prior adjustment was made, depending upon whether month i is a 31- or 30-day month or February. N_i is equal to the sum of the prior daily weights (Dp) for all the days of the month if a prior adjustment was made; I_i is the "true" irregular from month i.	$[I\,D_r] \rightarrow D_r$.	$[I{+}D_r] \rightarrow D_r$.

Part B. Preliminary Estimation of Trading-day Variation and Weights – Continued

Table number and title	Multiplicative and additive or log additive	Symbolic notation: Multiplicative	Symbolic notation: Additive or log additive
B15. Preliminary trading-day regression – Concluded	Let b_j denote the least-squares estimate of B_j and $\hat{\sigma}_j$ the standard error of b_j. **Multiplicative:** If prior weights (D_{pj}) are used, combine with regression weights by the formula: $D_j = b_j + D_{pj}$, where D_j are the combined weights. If no prior weights are available, use 1.0 for all D_p. Compute $t_j(p) = b_j/\hat{\sigma}_j$ and $t_j(1) = (D_j - 1.0)/\hat{\sigma}_j$ ($j = 1,---,7$) which are the t-ratios for testing whether combined weight D_j is significantly different from prior weight D_{pj} and 1.0, respectively. $\hat{\sigma}_j$ is also the standard error for D_j. **Additive:** $D_j = b_j$ and $t_j(0) = D_j/\hat{\sigma}_j$ ($j = 1,---,7$), where $t_j(0)$ is the t-ratio for testing whether D_j is significantly different from 0.0. If the computed t-ratios are greater than the tabled 1% level (2.62), messages of significance are printed. Compute $F = \sigma_D^2/\sigma_R^2$, where σ_D^2 and σ_R^2 are the variance explained by the regression and the residual variance, respectively. If the computed F-ratio is greater than the tabled 1% level (2.95), a message that significant trading-day variation is present is printed.		
B16. Trading-day adjustment factors derived from regression coefficients	Construct monthly calendar adjustment factors by the formula: **Multiplicative:** $M_i = \frac{X_{1i}(b_1+1.0)+X_{2i}(b_2+1.0)+----+X_{7i}(b_7+1.0)}{N_i};$ **Additive:** $M_i = X_{1i}b_1+X_{2i}b_2+----+X_{7i}b_7;$ where M_i is the monthly factor for month i; N_i is 31 or 30 where month i is a 31- or 30-day month. N_i is 28.25 for February if no prior adjustment was made. N_i is 29 or 28 for leap year and nonleap year February if a prior adjustment was made. Print out monthly factors in Table B16. Divide these factors into (B13) (**subtract these factors from (B13)**) to obtain an irregular component without trading-day variation.	$I' D_r/D_r = I'$.	$[I'+D_r] - D_r = I'$.
B17. Preliminary weights for irregular component	Compute a moving five-year σ of the irregular in B16 (or B13 if a trading-day adjustment is not made) and test the irregulars in the central year of the five-year period against 2.5 σ.		

Part B. Preliminary Estimation of Trading-day Variation and Weights – Concluded

Table number and title	Multiplicative and additive or log additive	Symbolic notation: Multiplicative	Symbolic notation: Additive or log additive
B17. Preliminary weights for irregular component – Concluded	For the first two years, the σ limits computed for the third year are used; and for the last two years, the σ limits computed for the third-from-end year are used. Remove values beyond 2.5σ and recompute the moving five-year σ. Assign a zero weight to irregulars beyond 2.5σ and a weight of 1.0 (full weight) to irregulars within $1.5\ \sigma$. Assign a linearly graduated weight between 0.0 and 0.1 to irregulars between $2.5\ \sigma$ and $1.5\ \sigma$. Print out the moving five-year σ's and the weights for the irregular component in Table B17.	$[I'] = w$.	$[I'] = w$.
B18. Trading-day factors derived from combined daily weights	Construct monthly trading-day factors from the combined prior and estimated trading-day factors developed in B15 using the same formula as shown in step B16 except that D_j is substituted for $(b_j+1.0)$.	$D = D_p\ D_r$.	
B19. Original series adjusted for trading-day and prior variation	Divide (subtract) (B18) into (from) (A1) or (B1) if prior adjustments are not made.	$C\ S\ I'D/D = C\ S\ I'$.	$[C+S+I'+D_r] - D_r = C+S+I'$.
B20. Extreme values	Estimate the extreme values from the irregulars I′ of B13 with the weights obtained from B17 as follows: **Multiplicative:** $I' / (1+W(I'-1))$ **Additive or Log Additive:** $I'\ (1-W)$		

Part C. Final Estimation of Trading-day Variation and Irregular Weights

The original series adjusted for trading-day variation is modified for extreme and near-extreme values with the B17 weights, and improved trend-cycle and seasonal estimates are obtained. These improved estimates are divided into (**subtracted from**) the original series, and final trading-day factors and weights are estimated from the resulting irregular.

Table number and title	Multiplicative and additive or log additive	Symbolic notation: Multiplicative	Symbolic notation: Additive or log additive
C1. Original series modified by preliminary weights and adjusted for trading-day and prior variation	Modify the original series adjusted for trading-day and prior variation (B19 or B1 if the trading-day option is not used) for extreme values by reducing the irregular variations where less than full weight was assigned to the irregular in B17.	$\frac{C\ S\ I'[1.0+w(I'-1.0)]}{I'}$ $= C\ S\ I^w$.	$[C+S+I'] - I'(1.0-w)$ $= C+S+I^w$.
C2. Preliminary trend-cycle	Same as (B2) except that (C1) is used.	$M_C[C\ S\ I^w] = C_3$.	$M_C[C+S+I^w] = C_3$.
C3. Not used			
C4. Modified S–I ratios (differences)	Divide (C2) into (C1) to obtain S–I ratios (subtract (C2) from (C1) to obtain S–I differences).	$C\ S\ I^w/C_3 = S\ I^w$.	$[C+S+I^w] - C_3 = S+I^w$.

Part C. Final Estimation of Trading-day Variation and Irregular Weights – Continued

Table number and title	Multiplicative and additive or log additive	Symbolic notation	
		Multiplicative	Additive or log additive
C 5. Seasonal factors	Same as B5 except that C4 ratios **(differences)** are used.	$M_S[S\ I^w] = S_3$.	$M_S[S+I^w] = S_3$.
C 6. Seasonally adjusted series	Divide (C5) into (C1) **(subtract (C5) from (C1))** to obtain a preliminary seasonally adjusted series.	$C\ S\ I^w/S_3 = C\ I^w$.	$[C+S+I^w]-S_3 = C+I^w$.
C 7. Trend-cycle	Apply the variable trend-cycle curve routine to (C6) to estimate a preliminary trend-cycle.	$M_C[C\ I^w] = C_4$.	$M_C[C+I^w] = C_4$.
C 8. Not used			
C 9. Modified S–I ratios **(differences)**	Divide (C7) into (C1) to obtain S–I ratios **(subtract (C7) from (C1) to obtain S–I differences).**	$C\ S\ I^w/C_4 = S\ I^w$.	$[C+S+I^w]-C_4 = S+I^w$.
C10. Seasonal factors	Same as B10 except that C9 S–I ratios **(differences)** are used.	$M_S[S\ I^w] = S_4$.	$M_S[S+I^w] = S_4$.
C11. Seasonally adjusted series	Reintroduce trading-day variation and extreme and near-extreme values by dividing (B1) by (C10) **(subtracting (C10) from (B1)).**	$C\ S\ I'D_r/S_4 = C\ I'D_r$.	$[C+S+I'+D_r]-S_4 = C+I'+D_r$.
C12. Not used			
C13. Irregular series	Divide (C11) by (C7) **(subtract (C7) from (C11))** to obtain an estimate of the irregular. Adjustment for Trading-day Variation (optional). When the trading-day routine is applied in B14 to B16 and B18 to B19, it is reapplied in C14 to C16 and C18 to C19 to obtain improved estimates.	$C\ I'\ D_r/C_4 = I'D_r$.	$[C+I'+D_r]-C_4 = I'+D_r$.
C14. Extreme irregular values excluded from trading-day regression	In reapplying the trading-day routine, the variance is computed using the 22 types of monthly trading-day factors shown in B16 instead of the means of the 31- and 30-day months and non-leap-year Februaries. This improves the treatment of extremes, particularly for leap-year Februaries. Extremes beyond 2.5 σ_t are shown in C14.	For $\lvert I'-1.0\rvert > 2.5\sigma_t$ $I'\ D_r$ removed from regression.	For $\lvert I'\rvert > 2.5\sigma_t$ $I'+D_r$ removed from regression.
C15. Final trading-day regression	Same as B15 except that the computations are based on C13 (with extremes omitted).	$[I\ D_r] \rightarrow D_r$.	$[I+D_r] \rightarrow D_r$.

Using the standard errors of the seven daily weights, compute estimates of the standard errors of the monthly calendar adjustment factors M_i as follows:

Multiplicative:

31-day months beginning on day-of-the-week j:

$$\hat{\sigma}_{M_{31}} = \frac{1}{31}[\hat{\sigma}_j^2+\hat{\sigma}_{j+1}^2+\hat{\sigma}_{j+2}^2$$

$$+2(\hat{\sigma}_{j,j+1}+\hat{\sigma}_{j,j+2}+\hat{\sigma}_{j+1,j+2})]^{1/2},$$

30-day months beginning on day-of-the-week j:

$$\hat{\sigma}_{M_{30}} = \frac{1}{30}[\hat{\sigma}_j^2+\hat{\sigma}_{j+1}^2+2\hat{\sigma}_{j,j+1}]^{1/2};$$

Leap-year Februaries: $\hat{\sigma}_{M_{29}} = \frac{1}{29}\hat{\sigma}_j$;

Non-leap-year Februaries: $\hat{\sigma}_{M_{28}} = 0$;

where $\hat{\sigma}_{j+7} = \hat{\sigma}_j$.

Part C. Final Estimation of Trading-day Variation and Irregular Weights – Concluded

Table number and title	Multiplicative and additive or log additive	Symbolic notation	
		Multiplicative	Additive or log additive
C15. Final trading-day regression – Concluded	If a length-of-month adjustment is included in the trading-day factors, the denominator of all $\hat{\sigma}_M$'s is 30.4375. Since the $\hat{\sigma}_M$'s, for each length month, are almost equal in practice, only one estimate is shown for each of the seven $\hat{\sigma}_{M_{31}}$'s, $\hat{\sigma}_{M_{30}}$'s and $\hat{\sigma}_{M_{29}}$'s. **Additive:** Same as multiplicative except that the denominator of σ_M's is 1.0 in all cases rather than 31, 30, 29 or 30.4375.		
C16. Final trading-day adjustment factors derived from regression coefficients	Same as B16 except that the factors are divided into (**subtracted from**) (C13).	$I' D_r/D_r = I'$.	$[I'+D_r] - D_r = I'$.
C17. Final weights for irregular component	Same as B17 except that C16 [or C13 if the trading-day option is not used] is used.	$[I'] = w$.	$[I'] = w$.
C18. Final trading-day factors derived from combined daily weights	Same as B18 except that the final residual weights estimated in C15 are used. If length-of-month variation is included with the trading-day factors, N_i is 30.4375 for all months. This option is not available with an additive adjustment.	$D = D_p D_r$.	
C19. Original series adjusted for trading-day and prior variation	Divide (**subtract**) (C18) into (**from**) (A1) or (B1) if prior modifications are not made.	$C\,S\,I'D/D = C\,S\,I'$.	$[C+S+I'+D_r] - D_r = C+S+I'$.
C20. Extreme values	Same as B20 except that C13 and C17 are used.		

Part D. Final Estimation of Seasonal Factors, Trend-cycle, Irregular, and Seasonally Adjusted Series

The original series adjusted for trading-day variation is modified for extreme and near-extreme values by the C17 final weights and final estimates of the seasonal, trend-cycle, and irregular are derived.

Table number and title	Multiplicative and additive or log additive	Symbolic notation	
		Multiplicative	Additive or log additive
D1. Original series modified by final weights and adjusted for trading-day and prior variation	Same as C1 except that C17 weights and C19 adjusted series are used.	$\frac{C\,S\,I'[1.0+w(I'-1.0)]}{I'}$ $= C\,S\,I^w$.	$[C+S+I'] - I'(1.0-w)$ $= C+S+I^w$.
D2. Preliminary trend-cycle	Same as (B2) except that (D1) is used.	$M_C[C\,S\,I^w] = C_5$.	$M_C[C+S+I^w] = C_5$.
D3. Not used			
D4. Modified S–I ratios (differences)	Divide (D2) into (D1) to obtain S–I ratios (**subtract (D2) from (D1) to obtain S–I differences**).	$C\,S\,I^w/C_5 = S\,I^w$.	$[C+S+I^w] - C_5 = S+I^w$.
D5. Seasonal factors	Same as B5 except that D4 ratios (**differences**) are used.	$M_S[S\,I^w] = S_5$.	$M_S[S+I^w] = S_5$.

Part D. Final Estimation of Seasonal Factors, Trend-cycle, Irregular, and Seasonally Adjusted Series – Continued

Table number and title	Multiplicative and additive or log additive	Symbolic notation	
		Multiplicative	Additive or log additive
D 6. Seasonally adjusted series	Divide (D5) into (D1) (**subtract (D5) from (D1)**) to obtain a preliminary seasonally adjusted series.	$C\,S\,I^w/S_5 = C\,I^w.$	$[C+S+I^w] - S_5 = C+I^w.$
D 7. Trend-cycle	Same as B7 except that D6 is used.	$M_C[C\,I^w] = C_6.$	$M_C[C+I^w] = C_6.$
D 8. Final unmodified S–I ratios (**differences**)	Divide (D7) into (C19) (**subtract (D7) from (C19)**) [or (B1) if the trading-day option is not used] to obtain final unmodified S–I ratios (**differences**). An F test and a non-parametric test for the presence of stable seasonality are applied to the SI ratios and messages are printed to indicate whether seasonality is present at the 0.1% level and 1% level, respectively (see Chapter I). A combined test for identifiable seasonality is performed with the above tests and a message is printed to indicate whether identifiable seasonality is present (see Chapter I).	$C\,S\,I'/C_6 = S\,I'.$	$[C+S+I'] - C_6 = S+I'.$
D 9. Final replacement values for extreme S–I ratios (**differences**)	Divide (D7) into (D1) (**subtract (D7) from (D1)**) to obtain S–I ratios (**differences**) modified for extreme and near-extreme values. Print out values not identical to the corresponding entries in D8. For each month, compute and print out the average year-to-year per cent change (**difference**) in estimates of the irregular ($\bar{I}'$) and the seasonal ($\bar{S}'$) and their ratio ($\bar{I}'/\bar{S}'$ = MSR = moving seasonality ratio), where S is an unweighted 7-term average of the D8 and D9 S–I ratios (**differences**) and I is obtained by dividing S into the ratios (**subtracting S from the differences**). The moving averages automatically selected by the program are: (1) the 3-term m.a. if MSR falls within 0 and 1.49; (2) the 3 x 3 term m.a. if the MSR falls within 1.50 and 2.49; (3) the 3 x 5 term m.a. if the MSR falls within 2.5 and 7; and (4) the n-term (stable seasonal) if MSR is greater than 7.	$C\,S\,I^w/C_6 = S\,I^w.$	$[C+S+I^w] - C_6 = S+I^w.$
D10. Final seasonal factors	Same as B10 except that D8 and D9 S–I ratios (**differences**) are used.	$M_S[S\,I^w] = S_6.$	$M_S[S+I^w] = S_6.$
D10A. Seasonal factors, one year ahead	Seasonal factor forecasts for one year are obtained from: (1) the extrapolated ARIMA values; or (2) the extrapolated final seasonal factors of D10 by the formula $S_{n+1} = S_n + 1/2[S_n - S_{n-1}]$ if the ARIMA option is not applied (see Chapter I).		
D11. Final seasonally adjusted series	Divide (D10) into (C19) (**subtract (D10) from (C19)** or (A1)) to obtain the final seasonally adjusted series. Note that D11 is the final seasonally and trading-day adjusted series if the trading-day option is applied A F test for the presence of residual seasonality is applied to the D11 values and a message is printed indicating whether there is residual seasonality: (1) for the whole series at the 1% level; and (2) for only the last three years, at the 1% and 5% levels (see Chapter I).	$C\,S\,I'/S_6 = C\,I'$	$[C+S+I'] - S_6 = C+I'.$

Part D. Final Estimation of Seasonal Factors, Trend-cycle, Irregular, and Seasonally Adjusted Series – Concluded

Table number and title	Multiplicative and additive or log additive	Symbolic notation	
		Multiplicative	Additive or log additive
D11A. Final seasonally adjusted series with revised yearly totals	This is an optional table that produces a modified seasonally adjusted series where the annual totals of D11 are equal to those of A1 or B1, when prior adjustments are not made (see Chapter I).		
D12. Final trend-cycle	Divide (D1) by (D10) **(subtract (D10) from (D1))** to obtain a modified seasonally adjusted series. Apply the variable trend-cycle curve routine to the modified seasonally adjusted series to obtain the final trend-cycle.	$M_C[C\ I^w] = C_7$.	$M_C[C{+}I^w] = C_7$.
D13. Final irregular	Divide (D12) into (D11) **(subtract (D12) from (D11))** to obtain the final irregular. Compute the standard deviation for each year, each month, and the entire series.	$C\ I'/C_7 = I'$.	$[C{+}I'] - C_7 = I'$.
D16. Combined seasonal and trading-day factors	Divide (A1) or (B1), if prior modifications are not made, by D11 **(subtract (A1) or (B1) if prior modifications are not made) from D11** to obtain the combined seasonal and trading-day factors.	$CSI'D_r/CI'$	$C{+}S{+}I'{+}D_r - [C{+}I']$

Part E. Modified Original, Seasonally Adjusted, and Irregular Series

The original and seasonally adjusted series and the irregular are modified for extremes (beyond 2.5 σ).

Tables E4, E5, and E6 provide aids to interpreting the quality of the seasonal adjustment.

Table number and title	Multiplicative and additive or log additive	Symbolic notation	
		Multiplicative	Additive or log additive
E1. Original series modified by extreme values with zero final weights.	Replace those values in the original series (A1 or B1) where a zero weight was assigned in C17 (beyond 2.5 σ) with the product **(sum)** of the trend-cycle, seasonal, trading-day and prior adjustment components shown in D12, D10, C18, and A2 to obtain an original series modified for extremes.	Where w = 0.0, I′ set equal to 1.0; i.e., $C\ S\ I''D = C\ S\ P\ D$.	Where w = 0.0, I′ set equal to 0.0; i.e., $C{+}S{+}I''{+}D_r = C{+}S{+}P{+}D_r$.
E2. Modified seasonally adjusted series	Replace those values in the final seasonally adjusted series (D11) where a zero weight was assigned in C17 with the D12 final trend-cycle values.	Where w = 0.0, I′ set equal to 1.0; i.e., $C\ I' = C$.	Where w = 0.0, I′ set equal to 0.0; i.e., $C{+}I' = C$.
E3. Modified irregular series	Replace those values in the final irregular series (D13) with 1.0 **(0.0)** where a zero weight was assigned in C17. Compute the standard deviation for each year, each month, and the entire series.	Where w = 0.0, I′ set equal to 1.0.	Where w = 0.0, I′ set equal to 0.0.
E4. Ratios **(differences)** of annual totals	Compute the ratios **(differences)** of the annual totals of **(between)** (a) the original (A1) to **(and)** the final seasonally adjusted (D11) series and (b) the modified original (E1) to **(and)** the modified seasonally adjusted (E2) series.		
E5. Per cent changes **(differences)** in original series	Compute and print out the individual month-to-month per cent change **(differences)** in A1.		

Part E. Modified Original, Seasonally Adjusted, and Irregular Series – Concluded

Table number and title	Multiplicative and additive or log additive	Symbolic notation: Multiplicative	Symbolic notation: Additive or log additive
E6. Per cent changes (differences) in final seasonally adjusted series	Compute and print out the individual month-to-month per cent changes (differences) in D11.		

Part F. MCD Moving Average and Summary Measures

Table number and title	Multiplicative and additive or log additive	Symbolic notation: Multiplicative	Symbolic notation: Additive or log additive
F1. MCD moving average	Compute an unweighted moving average of the final seasonally adjusted series (D11) with number of terms equal to MCD (see F2 for computation of MCD). When an even number of terms is used (MCD = 2,4,6), the moving average value is centred by taking an average of the two MCD values.	$M_{MCD}[C\,I'] = C_{MCD}$.	$M_{MCD}[C+I'] = C_{MCD}$.
F2A. Summary measures	**Average Per Cent Changes (Differences) Without Regard to Sign Over Selected Spans and MCD**		

Compute the average without regard to sign of the per cent changes (differences) for the following series over spans t = 1, to 12 months:

Table	Symbol	Series
A1	$\bar{O}_t$	Original series
D11	$\overline{CI}_t$	Final seasonally adjusted series
D13	$\bar{I}_t$	Final irregular series
D12	$\bar{C}_t$	Final trend-cycle
D10	$\bar{S}_t$	Final seasonal factors
A2	$\bar{P}_t$	Prior monthly adjustment factors
C18	$\overline{TD}(*)_t$	Final trading-day adjustment factors;
E1	$\bar{O}^M_t$	Modified original series
E2	$\overline{CI}^M_t$	Modified seasonally adjusted series
E3	$\bar{I}^M_t$	Modified irregular series

where * denotes no allowance for length-of-month variation and ** denotes allowance for length-of-month variation.

For each of the above series, average the per cent changes (differences) for each span t without regard to sign and print out the average with the table number of the series from which the per cent changes (differences) were computed and the symbol assigned above.

Part F. MCD Moving Average and Summary Measures – Continued

Table number and title	Multiplicative and additive or log additive	Symbolic notation	
		Multiplicative	Additive or log additive
F2B.	**Relative Contributions of Components to Per Cent Changes (Differences) in Original Series** Compute the relative contribution of each component to the per cent changes (differences) in the original series over each span t using the relationship $\bar{O}_t^2 \cong \bar{I}_t^2 + \bar{C}_t^2 + \bar{S}_t^2 + \bar{P}_t^2 + \bar{TD}_t^2$. Since the sum of squares of the per cent changes (differences) does not equal $\bar{O}_t^2$ exactly, substitute $\bar{O}'^2_t$, where $\bar{O}'^2_t = \bar{I}^2_t + \bar{C}^2_t + \bar{S}^2_t + \bar{P}^2_t + \bar{TD}^2_t$. Then compute the ratios $\bar{I}^2/\bar{O}'^2_t, \ldots, \bar{TD}^2_t/\bar{O}'^2_t$, which express the relative importance of the changes in each component. Also, compute the ratio $\bar{O}'^2_t/\bar{O}^2_t$ as an indicator of how well the approximation $\bar{O}'^2_t \cong \bar{O}^2_t$ holds.		
F2C.	**Means and Standard Deviations of Per Cent Changes (Differences)** Compute the mean and standard deviation of the per cent changes (differences) for O, I, C, S, CI and MCD over each span t (t = 1, . . ., 12). Print out the means and standard deviations of the per cent changes (differences) with the symbol and table number of the series from which the measures were computed.		
F2D.	**Average Duration of Run** Compute average duration of run (the average number of consecutive monthly changes in the same direction; "no change" is counted as a change in the same direction as the preceding change) for the following series: **Table** — **Symbol** — **Series** D11 — CI — Final seasonally adjusted series D13 — I — Final irregular series D12 — C — Final trend-cycle F1 — MCD — MCD moving average.		
F2E.	Compute and print out $\bar{I}_t/\bar{C}_t$ for t = 1, . . . , 12. Designate as the MCD span the shortest span for which $\bar{I}_t/\bar{C}_t < 1.0$.		
F2F.	**Relative Contribution of the Components to the Stationary Portion of the Variance of the Original Series** The series is made stationary by removing a linear trend for additive and log additive decompositions and an exponential trend for multiplicative decomposition. The relative contribution to the variance is calculated for I, C, S, P, TD and total.		

Part F. MCD Moving Average and Summary Measures – Concluded

Table number and title	Multiplicative and additive or log additive	Symbolic notation	
		Multiplicative	Additive or log additive
F2G.	**The Autocorrelation of the Final Irregular for Spans 1 to 14**		
F2H.	**The Final I/C Ratio from Table D12** **The Final I/S Ratio from Table D10**		
F2I.	**The Statistics Values and Their Corresponding Probability Levels:** F test for stable seasonality from Table B1; F test for the trading-day regressions from Table C15; F test for stable seasonality from Table D8; Kruskal-Wallis chi-square test for stable seasonality from Table D8; F-test for moving seasonality from Table D8.		
F3. Monitoring and quality assessment statistics	All the measures below are in the range from 0 to 3 with an acceptance region from 0 to 1 (see Chapter I). 1. The relative contribution of the irregular over one quarter span (from Table F2B), M1. 2. The relative contribution of the irregular component to the stationary portion of the variance (from Table F2F), M2. 3. The amount of month-to-month change in the irregular component as compared to the amount of month-to-month change in the trend-cycle (from Table F2H), M3. 4. The amount of autocorrelation in the irregular as described by the average duration of run (Table F2D), M4. 5. The number of months it takes the change in the trend-cycle to surpass the amount of change in the irregular (from Table F2E), M5. 6. The amount of year-to-year change in the irregular as compared to the amount of year-to-year change in the seasonal (from Table F2H), M6. 7. The amount of stable seasonality present relative to the amount of moving seasonality (from Table F2I), M7. 8. The size of the fluctuations in the seasonal component throughout the whole series, M8. 9. The average linear movement in the seasonal component throughout the whole series, M9. 10. Same as 8, calculated for recent years only, M10. 11. Same as 9, calculated for recent years only, M11. A message is printed indicating the level of acceptance for the combined statistics.		

Part G. Charts

Charts G1 and G2 and available as part of the standard printout. G3 and G4 are available optionally. The user may also specify that no charts are to be printed. See Chapter III for further details.

Part G. Charts – Concluded

Table number and title	Multiplicative and additive or log additive
G1. Chart	Plot the original series if prior modifications are not made (A1) or the modified series with extrapolated values (B1) and modified series (E1).
G2. Chart	Plot the final seasonally adjusted series and final trend-cycle (D11 and D12, respectively).
G3. Chart	Plot the final S–I ratios **(differences)** with extremes, final S–I ratios **(differences) without** extremes, and final seasonal factors (D8, D9, and D10, respectively).
G4. Chart	Plot in calendar order the final S–I ratios **(differences) with** extremes, final S–I ratios **(differences) without** extremes, and final seasonal factors (D8, D9, and D10 respectively).
G5. Chart	Plot the final irregular and final modified irregular (D13 and E3, respectively).
G6. Chart	Plot the cumulative periodogram of the final irregulars from Table (D13).
	Scales on Charts
	Multiplicative:
	The scales for Charts G1 and G2 are semi-log. The program selects one of the six following semi-log scales so as to maximize the space utilized by the charts themselves:
	5-cycle – largest value is 100,000 times the smallest value on the scale;
	4-cycle – largest value is 10,000 times the smallest;
	2-cycle – largest value is 100 times the smallest;
	1-cycle – largest value is 10 times the smallest;
	"half-cycle" – largest value is 4 times the smallest;
	"quarter-cycle" – largest value is twice the smallest.
	The scales for the charts in G3, G4, G5 and G6 are arithmetic. They are chosen so as to maximize the space utilized by the charts themselves.
	Additive:
	The scales for all charts are arithmetic and are chosen so as to maximize the space utilized by the charts themselves.

Specifications – Variable Trend-cycle Curve Routine

The steps in the variable trend-cycle curve routine are as follows:

1. As a preliminary estimate of C, compute a 13-term Henderson moving average of the seasonally adjusted series. Do not extend to ends of series.
2. As a preliminary estimate of I, divide **(subtract)** the 13-term moving average into (from) the seasonally adjusted series.
3. Compute the average month-to-month per cent change **(difference) without** regard to sign in the preliminary estimates of the irregular ($\bar{I}$) and the trend-cycle ($\bar{C}$). Compute their ratio ($\bar{I}/\bar{C}$) to obtain an estimate of the importance of the irregular variations relative to the movements in the trend-cycle.

$\bar{I}/\bar{C}$	Moving average
0.00 to 0.99	9-term Henderson
1.00 to 3.49	13-term Henderson
3.50 and over	23-term Henderson

For the weight patterns for the Henderson moving averages and the weights used for extending the averages at the ends of the series, see Appendix B.

Specifications – Quarterly Program (Multiplicative or Additive and Log Additive) X-11-ARIMA (Q)

The steps in the quarterly program are analogous to those in the monthly program with the following changes:

1. Options A2 and A4 are not applicable.
2. The tables dealing with trading-day variation (B14 to B16, B18 to B20, C14 to C16, C18 to C20) are not applicable.
3. The available options are slightly different from the monthly options. See Chapter III for further details.
4. The estimates of the trend-cycle are derived by a centred 4-term moving average (Tables B2, C2, D2) or an optional centred 8-term moving average. The final estimate of this trend-cycle (Tables B7, C7, D7, D12) is derived by a 5-term or a 7-term Henderson moving average selected by the program.

5. The seasonal factor estimates are adjusted to sum to 4.000 using a centred 4-term moving average (Tables B4, B5, B9, B10, C5, C10, D5, D10).
6. In step B7, replace an extreme value with the average of the value times its weight and the nearest full-weight value on either side. To replace a value in the first (**last**) quarter, replace the extreme value with average of the value times its weight and the nearest full-weight value.
7. In Table F2, the P and TD summary measures are not applicable. Summary measures are shown over one to four-quarter spans. Table F1 is quarters for cyclical dominance (QCD) moving average.

Appendix B

FIXED MOVING-AVERAGE WEIGHTS OF X-11-ARIMA

Seasonal-factor Curve Weights[1]

Text Tables I and II give the fixed weight patterns for the seasonal-factor curve moving averages available in X-11-ARIMA, the weights for extending the averages at the ends of the series, and the implicit weights for one year-ahead seasonal factors. The stable seasonal, uses an unweighted average of all available S–I ratios for all seasonal factors (including those at the ends) and the year-ahead factors. "N" is the last year for which an S–I ratios is available, and the weights for year "N+1" represent the implicit weights for the year-ahead seasonal factors.[1] **When the ARIMA option is used only the symmetric weights are fixed; the end weights and the implicit weights for the year-ahead seasonal factors change with the ARIMA model.**

[1] The weights used by the program have eight digits.

TEXT TABLE 1. Seasonal-factor Curve Fixed Moving Average Weights

Factor for year	Weight given S–I ratios in year				
	N-4	N-3	N-2	N-1	N
	3 x 3 moving average				
N+1	0	−.056	.148	.426	.481
N	0	0	.185	.407	.407
N-1	0	.111	.259	.370	.259
N-2	.111	.222	.333	.222	.111

Factor for year	N-6	N-5	N-4	N-3	N-2	N-1	N
	3 x 5 moving average						
N+1	0	0	−.034	.134	.300	.300	.300
N	0	0	0	.150	.283	.283	.283
N-1	0	0	.067	.183	.250	.250	.250
N-2	0	.067	.133	.217	.217	.217	.150
N-3	.067	.133	.200	.200	.200	.133	.067

Factor for year	N-10	N-9	N-8	N-7	N-6	N-5	N-4	N-3	N-2	N-1	N
	3 x 9 moving average										
N+1	0	0	0	0	−.014	.031	.096	.180	.208	.236	.265
N	0	0	0	0	0	.051	.112	.173	.197	.221	.246
N-1	0	0	0	0	.028	.092	.144	.160	.176	.192	.208
N-2	0	0	0	.032	.079	.123	.133	.143	.154	.163	.173
N-3	0	0	.034	.075	.113	.117	.123	.128	.132	.137	.141
N-4	0	.034	.073	.111	.113	.114	.116	.117	.118	.120	.084
N-5	.037	.074	.111	.111	.111	.111	.111	.111	.111	.074	.037

TEXT TABLE II. Seasonal Factor Curve Fixed Moving Average Weights for Series with a Shorter Span Than the Terms in the Average Applied[1]

Factor for year	Weight given S–I ratios in year				
	N-4	N-3	N-2	N-1	N
	five-year series – 3 x 5 moving average				
N+1	–.034	.134	.300	.300	.300
N	0	.150	.283	.283	.283
N-1	.067	.183	.250	.250	.250
N-2	.200	.200	.200	.200	.200

Factor for year	N-5	N-4	N-3	N-2	N-1	N
	six-year series – 3 x 5 moving average					
N+1	0	–.034	.134	.300	.300	.300
N	0	0	.150	.283	.283	.283
N-1	0	.067	.183	.250	.250	.250
N-2	.067	.133	.217	.217	.217	.150

Factor for year	N-4	N-3	N-2	N-1	N
	five-year series – 3 x 9 moving average				
N+1	.200	.200	.200	.200	.200
N	.200	.200	.200	.200	.200
N-1	.200	.200	.200	.200	.200
N-2	.200	.200	.200	.200	.200

Factor for year	N-5	N-4	N-3	N-2	N-1	N
	six-year series – 3 x 9 moving average					
N+1	–.007	.085	.176	.212	.248	.286
N	.051	.112	.173	.197	.221	.246
N-1	.167	.167	.167	.167	.167	.167
N-2	.167	.167	.167	.167	.167	.167

Factor for year	N-6	N-5	N-4	N-3	N-2	N-1	N
	seven-year series – 3 x 9 moving average						
N+1	–.014	.031	.096	.180	.208	.236	.265
N	0	.051	.112	.173	.197	.221	.246
N-1	.028	.092	.144	.160	.176	.192	.208
N-2	.143	.143	.143	.143	.143	.143	.143
N-3	.143	.143	.143	.143	.143	.143	.143

See footnote(s) at end of table.

TEXT TABLE II. Seasonal Factor Curve Fixed Moving Average Weights for Series with a Shorter Span Than the Terms in the Average Applied[1] – Concluded

Weight given S–I ratios in year

eight-year series – 3 x 9 moving average

Factor for year	N-7	N-6	N-5	N-4	N-3	N-2	N-1	N
N+1	0	–.014	.031	.096	.180	.208	.236	.265
N	0	0	.051	.112	.173	.197	.221	.246
N-1	0	.028	.092	.144	.160	.176	.192	.208
N-2	.032	.079	.123	.133	.143	.154	.163	.173
N-3	.125	.125	.125	.125	.125	.125	.125	.125

nine-year series – 3 x 9 moving average

Factor for year	N-8	N-7	N-6	N-5	N-4	N-3	N-2	N-1	N
N+1	0	0	–.014	.031	.096	.180	.208	.236	.265
N	0	0	0	.051	.112	.173	.197	.221	.246
N-1	0	0	.028	.092	.144	.160	.176	.192	.208
N-2	0	.032	.079	.123	.133	.143	.154	.163	.173
N-3	.034	.075	.113	.117	.123	.128	.132	.137	.141
N-4	.111	.111	.111	.111	.111	.111	.111	.111	.111

10-year series – 3 x 9 moving average

Factor for year	N-9	N-8	N-7	N-6	N-5	N-4	N-3	N-2	N-1	N
N+1	0	0	0	–.014	.031	.096	.180	.208	.236	.265
N	0	0	0	0	.051	.112	.173	.197	.221	.246
N-1	0	0	0	.028	.092	.144	.160	.176	.192	.208
N-2	0	0	.032	.079	.123	.133	.143	.154	.163	.173
N-3	0	.034	.075	.113	.117	.123	.128	.132	.137	.141
N-4	.034	.073	.111	.113	.114	.116	.117	.118	.120	.084

[1] Series with less than five complete years of data are always seasonally adjusted with the stable seasonality option.

Trend-cycle Curve Weights[2]

Text Table III gives the fixed weight pattern for the trend-cycle average used: (1) in the variable routine, i.e., 5- and 7-term Henderson curve for quarterly series and 9-, 13-, and 23-term Henderson curve for monthly series and corresponding sets of end weights; and (2) in the preliminary trend-cycle estimation, i.e., centred 8-term moving average for quarterly series and centred 24-term moving average for quarterly series and their corresponding end weights. "N" is the last month for which a value in the seasonally adjusted series is available.

[2] The weights used by the program have eight digits.

TEXT TABLE III. Trend-cycle Curve Moving Average Weights

Weight given CI values in quarter

5-term Henderson

C value for quarter:	N-4	N-3	N-2	N-1	N
N	0	0	−.073	.403	.670
N-1	0	−.073	.294	.522	.257
N-2	−.073	.294	.558	.294	−.073

7-term Henderson

C value for quarter:	N-6	N-5	N-4	N-3	N-2	N-1	N
N	0	0	0	0	−.073	.403	.670
N-1	0	0	0	−.073	.294	.522	.257
N-2	0	0	−.073	.294	.558	.294	−.073
N-3	−.059	.059	.294	.413	.294	.059	−.059

Weight given CI values in month

9-term Henderson

C value for month:	N-8	N-7	N-6	N-5	N-4	N-3	N-2	N-1	N
N	0	0	0	0	−.156	−.034	.185	.424	.581
N-1	0	0	0	−.049	−.011	.126	.282	.354	.298
N-2	0	0	−.022	0	.120	.259	.315	.242	.086
N-3	0	−.031	−.004	.120	.263	.324	.255	.102	−.029
N-4	−.041	−.010	.119	.267	.330	.267	.119	−.010	−.041

13-term Henderson

C value for month:	N-12	N-11	N-10	N-9	N-8	N-7	N-6	N-5	N-4	N-3	N-2	N-1	N
N	0	0	0	0	0	0	−.092	−.058	.012	.120	.244	.353	.421
N-1	0	0	0	0	0	−.043	−.038	.002	.080	.174	.254	.292	.279
N-2	0	0	0	0	−.016	−.025	.003	.068	.149	.216	.241	.216	.148
N-3	0	0	0	−.009	−.022	.004	.066	.145	.208	.230	.201	.131	.046
N-4	0	0	−.011	−.022	.003	.067	.145	.210	.235	.205	.136	.050	−.018
N-5	0	−.017	−.025	.001	.066	.147	.213	.238	.212	.144	.061	−.006	−.034
N-6	−.019	−.028	0	.066	.147	.214	.240	.214	.147	.066	0	−.028	−.019

23-term Henderson

C value for month:	N-22	N-21	N-20	N-19	N-18	N-17	N-16	N-15	N-14	N-13	N-12	N-11
N	0	0	0	0	0	0	0	0	0	0	0	−.077
N- 1	0	0	0	0	0	0	0	0	0	0	−.046	−.041
N- 2	0	0	0	0	0	0	0	0	0	−.022	−.025	−.025
N- 3	0	0	0	0	0	0	0	0	−.008	−.014	−.018	−.015
N- 4	0	0	0	0	0	0	0	−.001	−.008	−.013	−.012	−.003
N- 5	0	0	0	0	0	0	.003	−.006	−.011	−.011	−.002	.015
N- 6	0	0	0	0	0	.002	−.006	−.012	−.011	−.003	.015	.039
N- 7	0	0	0	0	.001	−.007	−.013	−.011	−.003	.015	.039	.068
N- 8	0	0	0	−.002	−.007	−.013	−.013	−.003	.014	.039	.068	.097
N- 9	0	0	−.003	−.010	−.015	−.014	−.005	.014	.040	.069	.097	.122
N-10	0	−.004	−.011	−.016	−.015	−.005	.013	.039	.068	.097	.122	.138
N-11	−.004	−.011	−.016	−.015	−.005	.013	.039	.068	.097	.122	.138	.148

TEXT TABLE III. Trend-cycle Curve Moving Average Weights – Concluded

	Weight given CI values in month										
	N-10	N-9	N-8	N-7	N-6	N-5	N-4	N-3	N-2	N-1	N
	23-term Henderson – Concluded										
C value for month:											
N	–.064	–.049	–.028	.002	.039	.084	.133	.182	.227	.263	.288
N- 1	–.035	–.024	–.004	.025	.061	.101	.141	.176	.203	.219	.224
N- 2	–.019	–.005	.018	.049	.082	.116	.146	.166	.177	.176	.166
N- 3	–.004	.015	.042	.073	.103	.129	.147	.154	.150	.134	.112
N- 4	.015	.040	.068	.098	.121	.137	.142	.136	.119	.095	.066
N- 5	.039	.067	.095	.119	.134	.139	.131	.114	.088	.059	.027
N- 6	.068	.096	.118	.134	.138	.132	.114	.089	.059	.027	.001
N- 7	.096	.120	.135	.140	.133	.116	.090	.060	.031	.005	–.015
N- 8	.120	.137	.140	.136	.118	.094	.064	.034	.008	–.010	–.021
N- 9	.138	.143	.137	.120	.095	.067	.037	.011	–.007	–.017	–.019
N-10	.144	.138	.122	.097	.068	.039	.013	–.005	–.015	–.016	–.011
N-11	.138	.122	.097	.068	.039	.013	–.005	–.015	–.016	–.011	–.004

	Weight given CI values in quarter								
	N-8	N-7	N-6	N-5	N-4	N-3	N-2	N-1	N
	centred 8-term moving average for preliminary trend-cycle estimation								
C value for quarter:[1]									
N-2	0	–.004	–.058	.008	.179	.254	.308	.242	.071
N-3	0	–.052	.001	.132	.293	.302	.249	.118	–.043
N-4	–.026	–.021	.125	.271	.302	.271	.125	–.021	–.026

	Weight given CI values in month											
	N-24	N-23	N-22	N-21	N-20	N-19	N-18	N-17	N-16	N-15	N-14	N-13
	centred 24-term moving average for preliminary trend-cycle estimation											
C value for month:[2]												
N- 7	0	.019	.011	–.002	–.016	–.026	–.031	–.027	–.017	–.001	.019	.044
N- 8	0	.018	.005	–.011	–.024	–.029	–.027	–.018	–.002	.017	.041	.065
N- 9	0	.012	–.004	–.018	–.026	–.025	–.018	–.004	.014	.034	.057	.081
N-10	0	.002	–.012	–.021	–.023	–.016	–.004	.012	.030	.047	.069	.093
N-11	0	–.011	–.020	–.021	–.014	–.003	.012	.027	.043	.059	.081	.102
N-12	0	–.022	–.023	–.016	–.003	.012	.028	.041	.056	.073	.091	.106
N-13	–.011	–.027	–.019	–.005	.011	.027	.042	.056	.072	.089	.103	.111

	N-12	N-11	N-10	N-9	N-8	N-7	N-6	N-5	N-4	N-3	N-2	N-1	N
	centred 24-term moving average for preliminary trend-cycle estimation – Concluded												
C value for month:													
N- 7	.070	.064	.072	.085	.100	.110	.114	.110	.100	.084	.064	.039	.014
N- 8	.090	.065	.079	.094	.107	.113	.111	.101	.085	.066	.042	.018	–.006
N- 9	.106	.071	.087	.101	.110	.109	.101	.087	.069	.049	.027	.003	–.022
N-10	.115	.081	.096	.105	.106	.099	.087	.072	.054	.036	.014	–.010	–.032
N-11	.118	.094	.103	.104	.098	.086	.071	.056	.040	.024	.002	–.019	–.034
N-12	.115	.106	.107	.099	.086	.071	.055	.042	.027	.010	–.008	–.023	–.031
N-13	.106	.111	.103	.089	.072	.056	.042	.027	.011	–.005	–.019	–.027	–.011

[1] No estimates are computed for N and N-1.
[2] No estimates are computed for N, N-1, . . . , N-6.

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